COASTAL MULTISPECIES PLAN

Northern California Steelhead Summer-Run Adult, Middle Fork Eel River, CA. Photo Courtesy: Scott Harris, CDFW

VOLUME III

NORTHERN CALIFORNIA STEELHEAD

FINAL

2016

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LITERATURE CITATION SHOULD READ AS FOLLOWS:

National Marine Fisheries Service. 2016. Final Coastal Multispecies Recovery Plan. National Marine Fisheries Service, West Coast Region, Santa Rosa, California.

ADDITIONAL COPIES MAY BE OBTAINED FROM:

Attn: Recovery Team
National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, CA 95404

Or on the web at
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead.html

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INTRODUCTION TO NC STEELHEAD DPS RECOVERY

The Northern California (NC) steelhead Distinct Population Segment (DPS) historically consisted of five Diversity Strata with 41 independent populations of winter-run steelhead (19 functionally independent and 22 potentially independent) and 10 populations of summer steelhead (all functionally independent) (Spence *et al.* 2008; Spence *et al.* 2012). The delineation of the NC steelhead DPS Diversity Strata was based on environmental and ecological similarities and life history differences between winter run and summer run steelhead. Five strata were identified by Bjorkstedt *et al.* (2005): Northern Coastal, Lower Interior, North Mountain Interior, North Central Coastal, and Central Coastal. We have selected 51 winter-run populations across the five Diversity Strata and 10 summer-run populations across two Diversity strata to represent the recovery scenario for the NC steelhead DPS (Figure 1).

The biological recovery criteria for these populations are (See also Biological Recovery Criteria):

- 27 essential independent populations attaining low extinction risk criteria (*i.e.*, Garcia River, Gualala River, Navarro River, Chamise Creek, Outlet Creek, Tomki Creek, Woodman Creek, Larabee Creek, Middle Fork Eel River, North Fork Eel River, Upper Mainstem Eel River, Van Duzen River, Big River, Noyo River, Ten Mile River, Usal Creek, Wages Creek, Maple Creek/Big Lagoon, Bear River, Humboldt Bay Tributaries, Little River (Humboldt County), Mattole River, South Fork Eel River, Mad River (Upper), Mad River (Lower), and Redwood Creek (Upper) and Redwood (Lower) (Humboldt County));
- Ten supporting independent populations attaining moderate extinction risk criteria (*i.e.*, Brush Creek, Elk Creek, Bell Springs, Bucknell Creek, Dobbyn Creek, Garcia Creek, Jewett River, Albion River, Cottaneva Creek and Pudding Creek); and
- 14 dependent populations contributing to redundancy and occupancy (*i.e.*, Schooner Gulch, Soda Creek, Caspar Creek, Guthrie Creek, Oil Creek, Big Creek, Big Flat Creek, Howe Creek, Jackass Creek, Lower Mainstem Eel River, McNutt Gulch, Shipman Creek, Spanish Creek, and Telegraph Creek).

- Ten independent summer-run steelhead populations expected to meet effective population size criteria (Table 1) (*i.e.,* Redwood Creek, Mad River, South Fork Eel River, Mattole River, Van Duzen River, Larabee Creek, North Fork Eel River, Upper Middle Mainstem Eel River, Middle Fork Eel River, and Upper Mainstem Eel River).

All populations in the DPS will retain ESA protections and critical habitat designation regardless of their status or role in the recovery scenario.

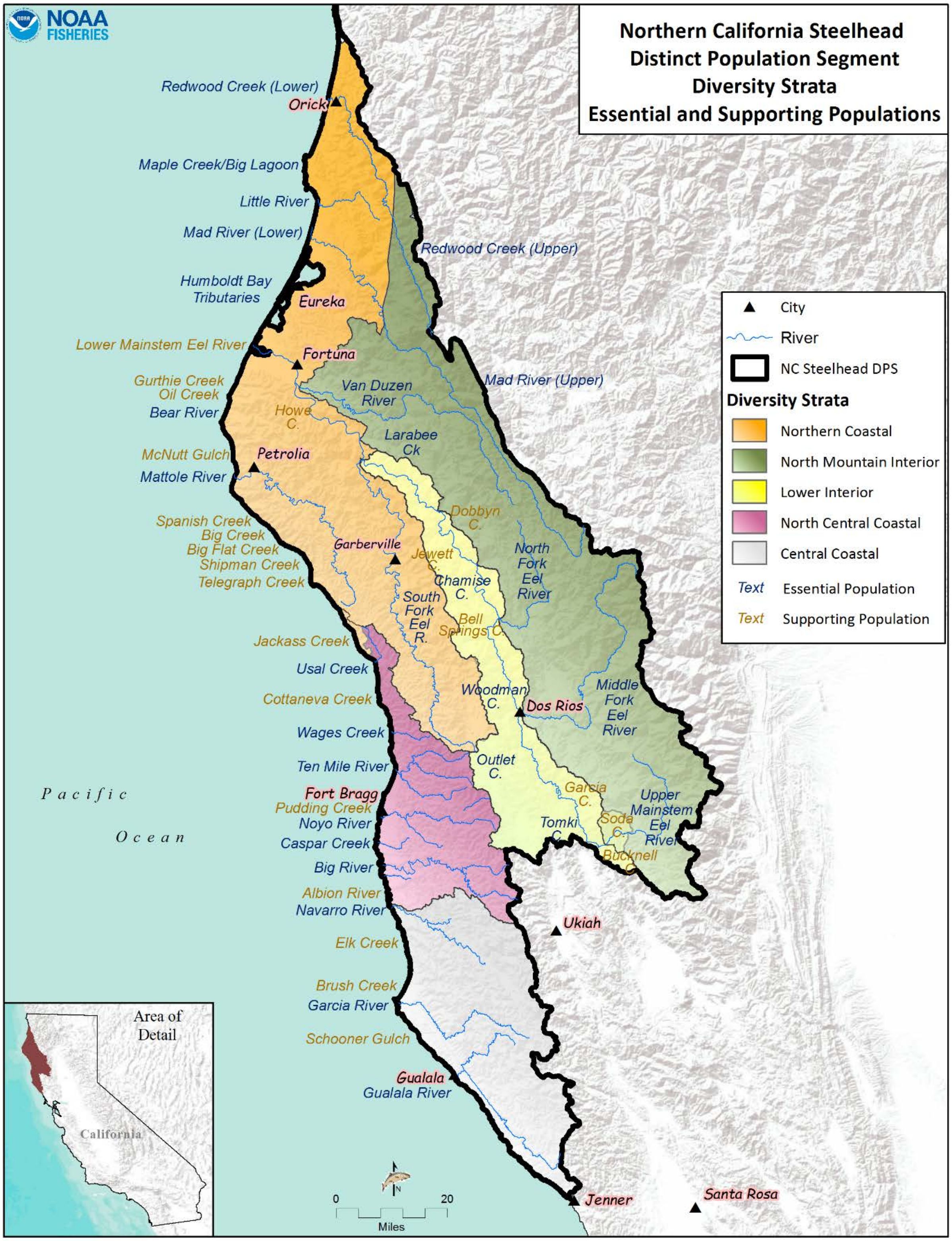

Figure 1: NC Steelhead Winter-Run Essential and Supporting Populations

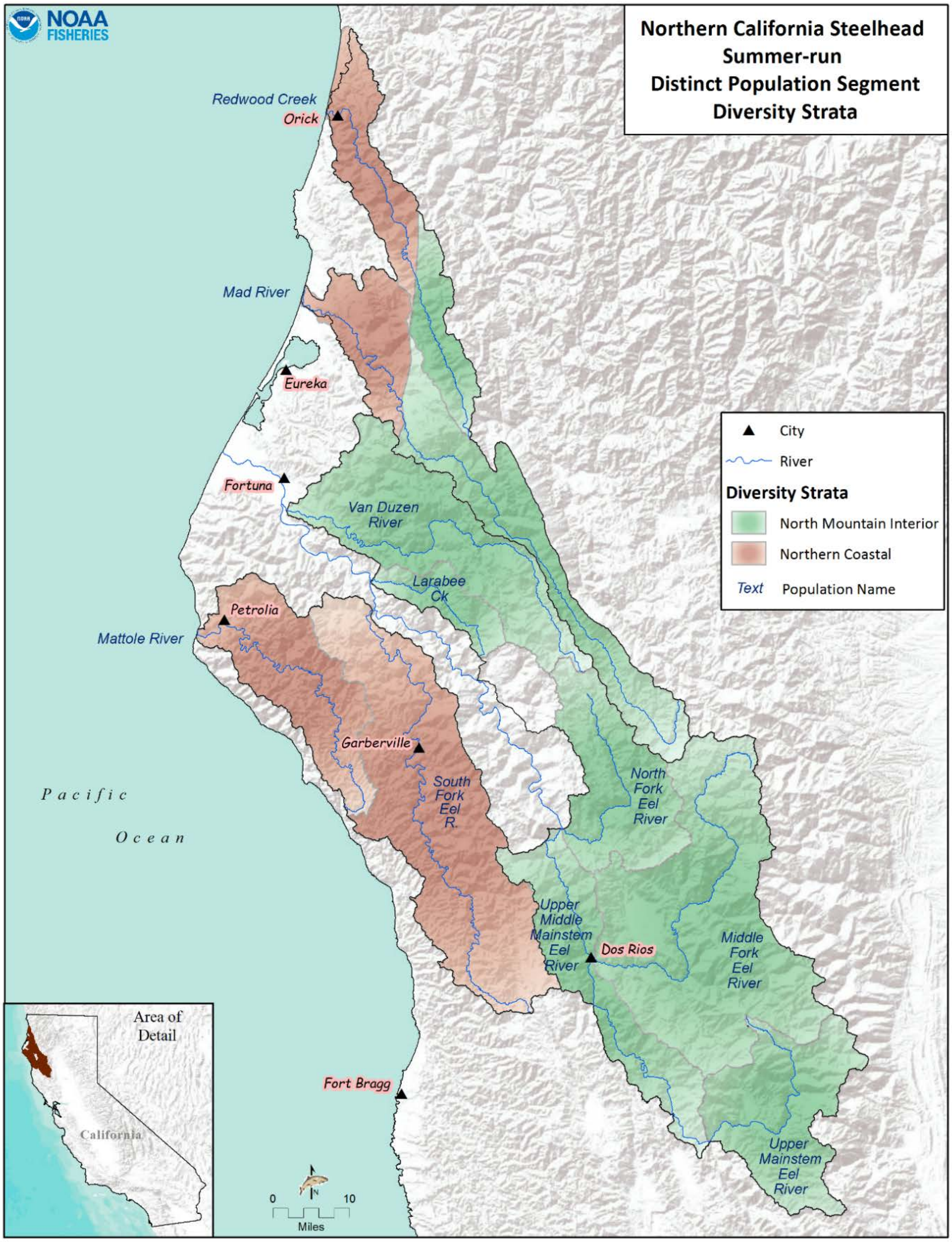

Figure 2: NC Steelhead Summer-Run Populations and Diversity Strata boundaries.

NC STEELHEAD DPS LISTING, REVIEWS & RECOVERY CRITERIA

The NC steelhead DPS was listed as a federally threatened species in 2000 (65 FR 36074). Status reviews conducted in 2005 and 2010 affirmed the threatened status of the species. This section of Volume III includes a description of the listing decision for the NC steelhead DPS, the ESA section 4(a)(1) threats identified at listing, a summary of findings from the two status reviews including the status of protective/conservation efforts, and NC steelhead recovery criteria.

NC STEELHEAD LISTING

In response to numerous petitions, and as the result of a comprehensive status review of West Coast steelhead (Busby *et al.* 1996), the NC steelhead ESU was proposed for listing as threatened under the ESA on August 9, 1996 (61 FR 56138). On August 18, 1997, the final listing determination for the NC steelhead ESU was extended for 6 months due to substantial scientific disagreement about the sufficiency and accuracy of data relevant to the determination (62 FR 43974). On March 19, 1998, NMFS determined the NC steelhead ESU did not warrant listing as a threatened species under the ESA at that time, but concluded that the ESU warranted classification as a candidate species under the ESA and noted the intent to review the determination no later than four years from the date of the Federal Register notice (63 FR 13347). Because the State of California did not implement conservation measures that NMFS considered critically important in its decision not to list the NC steelhead ESU, NMFS completed an updated status review and reconsidered the status of the ESU under the ESA. NMFS proposed the NC steelhead ESU for listing as threatened under the ESA on February 11, 2000 (65 FR 6960). On June 7, 2000, the NC steelhead ESU was listed as threatened under the ESA (65 FR 36074). On January 5, 2006, after an updated status review on a number of West Coast salmonid ESUs, NMFS reaffirmed the threatened status of NC steelhead and applied the DPS policy to the species noting that the resident and anadromous life forms of *O. mykiss* remain "markedly separated" as a consequence of physical, physiological, ecological, and behavioral factors, and may thus warrant delineation as separate DPSs (71 FR 834). The listed DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations in California coastal river basins from Redwood Creek southward to, but not including, the Russian River, as well as two artificial propagation programs that are no longer active: the Yager Creek hatchery and North Fork Gualala River Hatchery (Gualala River Steelhead Project) steelhead hatchery programs. The inadequacy of regulatory mechanisms, destruction and modification of habitat, and natural and man-made factors were identified as the primary causes for the decline of NC steelhead DPS (NMFS 1996).

NC STEELHEAD SECTION 4(A)(1) THREATS

Section 4(a)(1) of the ESA and the listing regulations (50 CFR part 424) set forth procedures for listing species. The Secretary of Commerce must determine through the regulatory process if a species is endangered or threatened based upon any one, or a combination of, the following ESA section 4(a)(1) factors:

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;

(B) overutilization for commercial, recreational, scientific, or educational purposes;

(C) disease or predation;

(D) the inadequacy of existing regulatory mechanisms; and

(E) other natural or manmade factors affecting its continued existence.

Through the regulatory process, the Secretary of Commerce determined the NC steelhead DPS was a threatened species based on their status and threats associated with the five section 4(a)(1) factors. NMFS concluded that habitat degradation associated with forest practices was a significant contributor to the reduction in abundance and distribution of NC steelhead (65 FR 6960). The specific threats associated with the section 4(a)(1) factors are summarized below.

Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Factor A At Listing:

Habitat degradation identified at the time of listing included reduced habitat complexity, riparian removal, sedimentation, altered instream flows, degradation of water quality, instream wood removal, and poor estuarine habitats. At listing both natural conditions and anthropogenic activities were identified as the source of the habitat degradation. These anthropogenic and natural conditions included: agriculture, logging, ranching, recreation, mining, habitat blockages, water diversions, artificial propagation, estuarine destructions or modification, flooding, hydropower development, instream habitat problems, lack of data, general land use activities, poaching, predation, recreational angling, urbanization, and water management.

Two habitat blockages were documented that reduced historical spawning and rearing access: Mathews Dam on the Mad River and Scott Dam on the Eel River. Matthews dam was found to block an estimated 36% of historical habitat. Scott Dam was found to block access to an estimated 99% of historical spawning and rearing habitat upstream of Soda Creek.

Factor A Since Listing:

A more recently recognized threat, illicit agriculture (specifically, illicit marijuana cultivation, a growing new threat within the DPS), falls within the previously recognized threat category of agriculture, generally, but is distinguished by being an illegal unregulated activity that does not benefit from the resource management oversight afforded by regulated agricultural operations. Unregulated pesticides use, habitat destruction, and illegal damming and diversion of rural streams and rivers for the purpose of irrigating illegal marijuana growing operations is likely now the paramount threat to salmonid survival and habitat function in many first and second-order streams located in remote, rural areas.

The restoration of salmon and steelhead habitats has been a primary focus of Federal, State and local entities. The State of California Fisheries Restoration Grant Program (FRGP) alone has invested over $250 million dollars and supported approximately 3,500 salmonid restoration projects. These projects include fish passage, water conservation, improving instream habitats, watershed monitoring, education and organizational support to watershed groups. Many other entities have made investments to improve the range and habitat of steelhead. Roni *et al*.(2010) indicated the percentage of floodplain and in-channel habitat that would need to be restored to detect a 25% increase in salmon and steelhead production was 20%. There has been far more than 20% of floodplain and in-channel habitat restored due to FRGP. Extensive restoration in NC steelhead populations has improved conditions; however, the activities that led to habitat degradation continue.

Although Matthews Dam on the Mad River was identified as a substantial habitat blockage at the time of listing (McEwan and Jackson 1996), the dam is now believed to block only 2 miles of historical spawning and rearing habitat. The 2 miles are believed to be of low value habitat and a portion of the river which naturally went intermittent and dry during the summer/fall months. The flows coming from Matthews Dam have improved in-river flows for summer steelhead and juvenile steelhead rearing year-round. Many of the physical effects to habitat normally associated with dams are less severe with this blockage than other dams.

All threats identified at listing continue to impair NC steelhead and their habitats. We have identified a number of threats originally discussed under Factor A that should be evaluated under a different ESA section 4(a)(1) factor. Thus, threats associated with a specific land use practice are discussed under Factor D (inadequacy of regulatory mechanisms), fishing under Factor B (overutilization), predation under Factor C (disease and predation) and flooding under Factor E (other natural or manmade factors).

Please see the NC steelhead 2016 ESA 5-Year Status Review for a more details on the current status of Listing Factor A (NMFS 2016).

<u>Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes</u>

Factor B At Listing:

Threats identified for Factor B at listing included historical over-fishing, poaching, unauthorized driftnet fishing on the high seas, scientific utilization and commercial, recreational and tribal harvest. Steelhead have been an important freshwater recreational and tribal fishery. Over-fishing in the early days of European settlement led to the depletion of many stocks of steelhead even before extensive habitat degradation. Anglers have been allowed to retain only hatchery fish. The mortality rates from incidental catch and release were unknown as was the level of illegal retention. During periods of decreased habitat availability (*i.e.*, drought or low flow conditions), recreational fisheries have had greater impact on wild steelhead. Poaching was considered a serious problem especially in the tributaries of the Middle Fork Eel River and Redwood Creek. Utilization for scientific research and education programs was identified as having little impact on NC steelhead populations (NMFS 1996) since take of this nature is via the issuances and conditioning of scientific permits. However, no comprehensive total or estimate of steelhead mortalities related to scientific sampling is kept for any watershed or steelhead stock in the state.

Factor B Since Listing:

The impacts of commercial or recreational ocean harvest are relatively unknown. . The impact of freshwater recreational angling is thought to be low for steelhead in this DPS; however, the actual level of impact cannot be estimated with existing data. Recreational steelhead fishing is popular within this DPS and on the Mad River there is a bag limit of two hatchery steelhead. In streams where only catch and release fishing is allowed, all wild steelhead must be released without further harm. There are also significant restrictions on gear used for angling. During periods of decreased habitat availability (drought or low flow conditions), recreational fisheries have a greater impact on wild steelhead. However, in 2015 the California Fish and Game Commission adopted regulations that prohibit fishing for NC steelhead during low flow conditions. CDFW has the authority under Title 14, California Code of Regulations, Section 8.00 to close select streams to fishing during specific months (depending on the area) when it determines that stream flows are below specific minimum flows or inadequate to provide fish passage for migrating steelhead trout and salmon (depending on the area). These new regulations only apply to twelve watersheds in Mendocino County. The regulations are intended to provide fishing opportunity when conditions allow for ample upstream and downstream movement by adult steelhead. These regulations will likely reduce the threat of recreational angling to NC steelhead during low flow periods.

Poaching and illegal retention is likely a threat in some populations. CDFW and the California Fish and Game Commission have made an effort to lessen this threat by implementing the low flow fishing closures. The problem with poaching continues to plague summer steelhead due to the absence of adequate law enforcement (Moyle *et al.* 2008). Although fishing is prohibited in many areas and fines for violations are high, protection of summer steelhead populations requires special enforcement efforts (Moyle *et al.* 2008). Species identification and proper handling and release techniques, when incidental capture of NC steelhead occurs is critical to reduce the likelihood of mortality and ensure NC steelhead adults survive to reproduce. Releasing NC steelhead unharmed requires specific handling, hook removal, revival efforts and minimal air exposure time (*i.e.*, time out of the water).

Since the listing of this DPS, the take of NC steelhead for scientific research and other purposes has been closely controlled by CDFW and NMFS through the issuance and conditioning of collection permits via a Biological Opinion (NMFS 2012) and NMFS' approval of the CDFW Research Program under 50 CFR 223.203 (promulgated by NMFS under ESA section 4(d), this regulation includes an exception to take prohibitions for a state research program approved by

NMFS). Tracking of authorized take began in 2004. Beginning in 2009, project applications were submitted online at the NMFS online application website Authorizations and Permits for Protected Species (APPS). APPS has allowed for improved annual tracking of lethal and non-lethal take requested, approved and reported for natural and listed hatchery-origin adults, smolts and juveniles. APPS data are analyzed annually to determine level of take for the DPS. Between 2004 and 2010, the actual reported percent mortality of NC steelhead juveniles and smolts for each year was at (or less than) 1 percent. The conclusion in the Biological Opinion (NMFS 2012) is that take associated with the CDFW Research Program is not likely to jeopardize the continued existence of NC steelhead.

Please see the NC steelhead 2016 ESA 5-Year Status Review for a more details on the current status of Listing Factor B (NMFS 2016).

Factor C: Disease or Predation

Factor C At Listing:

At listing, avian, marine mammal, pikeminnow, freshwater predation and disease were identified as threats for Factor C. Predation was considered a threat mostly in circumstances with introduced non-natives, low steelhead populations, habitat conditions leading to concentrations of steelhead in small areas or where avoidance habitats such as deep pools, undercut banks, or quality estuarine areas were compromised or lost. Marine predation was not well understood, but most investigators believed it to be a minor factor in steelhead declines. Pikeminnow predation in the Eel River and striped bass were considered major problems. No reliable data were available regarding the predation rates of striped bass, sea lions and harbor seals.

Diseases were attributed to hatchery-related activities, injury during passage through man-made impediments and habitat conditions leading to low water flows and high temperatures. However, very little historical information existed to quantify changes in infection levels and mortality rates attributable to disease. The listing indicated there was insufficient available information to suggest that the DPS was in danger of extinction because of disease or predation.

Factor C Since Listing:

Disease and predation were not considered major factors causing the decline of the NC steelhead DPS. Many common disease pathogens exist in wild populations, but increased individual resistance and natural ecological dynamics limit disease outbreaks and any resulting population-level impacts. Production hatcheries (i.e., those producing fish intended for angling opportunities) can have increased incidences of disease and related mortality, likely due to overcrowding and sub-optimal habitat conditions that can lower the natural immunity of individual fish. However, there are few hatcheries that exist within the NC steelhead DPS that would be a source for an outbreak of disease. No new information has emerged since listing that would suggest disease impacts have elevated in the time since, or that disease impacts are more than a minor factor in the present state of the NC steelhead DPS.

Please see the NC steelhead 2016 ESA 5-Year Status Review for a more details on the current status of Listing Factor C (NMFS 2016).

Factor D: Inadequacy of Existing Regulatory Mechanisms

Factor D At Listing:

At the time of listing, a variety of state and Federal regulatory mechanisms were in place to protect steelhead and their habitats. However, due to funding and implementation uncertainties and the voluntary nature of many programs, those regulatory mechanisms did not provide sufficient certainty that combined Federal and non-federal efforts were successfully reducing threats to NC steelhead. The following were identified as having inadequate regulatory mechanisms at the time of listing:

- California Department of Transportation (Caltrans)
- California Fish and Game Commission

    - Rearing programs
    - Steelhead policy
    - Water development and wetlands resources policy
- California Forest Practice Rules
- California Regional Water Quality Control Board
- California Department of Fish and Wildlife
    - Hatchery and Harvest Management
    - State Fishing Regulations
    - California Fish and Game Code Sections 1602/1603, 2786, 6900-6930
    - Keene-Nielsen Fisheries Restoration Act of 1985
    - Bosco-Keene Renewable Resources Investment Fund
    - Salmon and Steelhead Stock Management Policy
    - Steelhead Trout Catch Report-Restoration Card
    - Trout and Steelhead Conservation and Management Planning Act of 1979
    - Steelhead Restoration and Management Plan
    - Fishery Restoration Grant Program (FRGP)
    - California Coastal Salmonid Monitoring Program
- County Planning Efforts
- EPA/Water Quality
    - Water Quality Programs and TMDLs
    - Coastal Waters Program
    - Comprehensive Conservation and Management Plan for the San Francisco Bay-Delta Estuary
    - Wetland Protection Grants
- Five Counties MOU
- Gravel Mining Plans
- NMFS
    - ESA section 7

    - Section 10 and HCPs, including Green Diamond HCP and Pacific Lumber Company (PALCO) HCP
    - Pacific Coastal Salmon Recovery Fund
    - California Coastal Salmonid Monitoring Program
- Northcoast Regional Water Quality Control Board
- Pacific Fisheries Management Council
- Pacific Coast Ocean Salmon Fishery Management Plan and Magnuson-Stevens Act
- RCDs, Watershed Organizations and Private Companies
- US Army Corp of Engineers
    - Dredge, Fill and In-water Construction Programs
    - Section 404 of the Clean Water Act
- USDA Forest Service: Northwest Forest Plan and PACFISH

Factor D Since Listing:

For regulatory mechanisms to be deemed adequate they must be regulatory, not voluntary, enforced and found to effectively address threats to steelhead. Since listing, a number of factors outlined in the Federal Register listing NC steelhead persist, have improved or have been identified as not relevant. The primary regulatory mechanisms that protect NC steelhead are not comprehensive and are vastly different across the landscape and land use type. For example: timber operations abide by California's Forest Practice Rules while other land uses have little to no oversight or salmonid protections rely on State regulations or county ordinances when those mechanisms are triggered.

<u>Federal and State Land Management</u>

Timber harvest and associated road building was noted as a limiting factor during listing. Federally, the Northwest Forest Plan (NFP) has generally accomplished the goal of slowing aquatic degradation that had been accelerating under previous forest management programs (Reeves 2006). Recent changes to the California Forest Practice Rules have improved riparian habitat protection on private timber lands, which make up the vast majority of timberland in the NC steelhead DPS. Aside from updates to the California Forest Practice Rules, few changes to state land management programs have occurred since the last status review in 2016 (NMFS 2016; Williams *et al.* 2016).

Regulating and managing marijuana cultivation, while not specifically a land management issue, is nevertheless critically important in the effort to minimize environmental damage resulting from illegal marijuana grows. Medical Marijuana Regulation and Safety Act, which was signed into law in October 2015, has strong potential in minimizing marijuana cultivation impacts to the environment. This new law established a state-controlled regulatory and enforcement program that will control the permitting, regulation, and taxing of the medical marijuana industry.
While political efforts may dramatically change the marijuana cultivation landscape in California, the efficacy of any regulatory scheme to minimize grow-related environmental impacts would depend on specific details unknown at this time. Having environmental advocates (i.e., resource agencies or environmental NGOs) included as part of any legislative deliberations on the subject is critical toward crafting strong legalization laws that adequately and effectively minimize grow-related impacts.

The North Coast Regional Water Quality Control Board (NCRWQCB) currently has implemented a waste discharge waiver for state-legal medicinal marijuana cultivation[1]. The waiver program attempts to regulate and manage waste discharge into surface water bodies in a manner similar to other agricultural industries in the state, such as vineyards and grazing, with a tiered approach that places prospective operations into one of four different levels based largely on the areal size of the operation. All growers regulated under the waiver program will be required to implement specific Best Management Practices identified by the NCRWQCB, with program compliance verified either through self-reporting (for the smaller farms) to inspection

[1] http://www.waterboards.ca.gov/northcoast/water_issues/programs/cannabis/

by state agency personnel for larger operations. While the marijuana cultivation waste discharge waiver shows promise toward minimizing water quality-related impacts resulting from marijuana cultivation, the realized benefit may be smaller than anticipated due to the suspected large number of illegal grows (*i.e.*, not for medicinal uses, but for black market sales) and the low likelihood that criminal operators will voluntarily register with a state agency.

Federal and State Water Management:

Groundwater regulation and management should improve in the coming decades following the 2014 passage of the Groundwater Sustainability Management Act; however, surface water throughout the state is heavily over-allocated (Grantham and Viers 2014), and little change to the regulatory status quo concerning surface water rights and permitting is expected in the near future. As the state adapts to future climate variability combined with a period of accelerated population growth, the demands placed upon streams and rivers for surface water supplies will likely grow. Many large rivers and stream in the NC steelhead DPS are listed by the Environmental Protection Agency and State Water Quality Control Board as impaired for temperature and sediment pollution (per Section 303(d) of the Clean Water Act[2]). Many of the waterbodies listed will have Total Maximum Daily Loads identified, and an action plan for achieving that load, by 2019, which when implemented will improve salmonid habitat in affected streams.

Dredge, fill and instream construction programs

The U.S. Army Corps of Engineers, through their authority under the Clean Water Act, regulate dredge and fill within the ordinary high water mark of streams, rivers, wetlands, and other waterbodies. Anyone proposing to conduct a project that requires a federal permit or involves dredge or fill activities that may result in a discharge to U.S. surface waters and/or "Waters of the State" is required to obtain a Clean Water Act Section 401 Water Quality Certification and/or

[2] Information on the 303(d) list can be found at:
http://www.swrcb.ca.gov/water_issues/programs/tmdl/integrated2010.shtml

Waste Discharge Requirements (Dredge/Fill Projects) from the Regional Water Quality Control Board, verifying that the project activities will comply with state water quality standards. These Water Quality Certifications establish enforceable conditions necessary for compliance with California State water quality standards. In addition, the RWQCBs issue permits for dredge and fill activities outside of the U.S. Army Corps of Engineers' jurisdiction. These permits include the Statewide General Waste Discharge Requirements for Dredged or Fill Discharges to Waters Deemed by the U.S. Army Corps of Engineers to be Outside of Federal Jurisdiction (Order No. 2004-0004-DWQ), and in the North Coast Region the Categorical Waiver for Minor Dredging and Fill Operations, adopted through Resolution No. R1-2012-0099. CDFW performs a similar role through their Streambed Alteration Agreement program (Fish and Game Code section 1602).

Please see the NC steelhead 2016 ESA 5-Year Status Review for a more details on the current status of Listing Factor D (NMFS 2016).

<u>Factor E: Other Natural and Man-made Factors Affecting the Species' Continued Existence</u>

Factor E At Listing:

The manmade factors of artificial propagation and hatchery programs and the natural factors (*i.e.*, severe weather patterns), of drought, floods, El Nino events, climatic conditions, fires, variability in natural environmental conditions and ocean conditions were identified as threats under Factor E at the time of listing.

Artificial propagation was identified as negatively affecting wild stocks of salmonids through interactions with non-native fish, introductions of disease, genetic changes, competition for space and food resources, straying and mating with native populations, loss of local genetic adaptations, mortality associated with capture for broodstock and palliating the destruction of habitat and concealing problems facing wild stocks. The propagation programs identified were

Yager Creek/Van Duzen, Van Arsdale Fish Station, Mad River, Noyo River and the North Fork Gualala hatchery.

Persistent drought conditions were found to further reduce already limited spawning, rearing and migration habitats. Drought conditions combined with agriculture and urban water use was identified as likely to result in substantial reduction or elimination of water flows in streams needed by all life stages of steelhead. Flooding was found to contribute sediment to already degraded habitats as northern California has some of the most erodible terrain in the world. Wildfires were identified as contributing to short-term sediment runoff to streams and chemical agents used to control fires have degraded water quality conditions.

Decreased ocean productivity and lower ocean survival of steelhead combined with lower freshwater survival due to degraded and altered riverine and estuarine habitats were found to be significant factors for decline.

Factor E Since Listing:

Yager Creek/Van Duzen, Van Arsdale Fish Station, Noyo and the North Fork Gualala hatchery programs have been terminated. The Mad River Hatchery continues to be operational. CDFW is currently working with NMFS in the development of a Hatchery and Genetic Management Plan for the Mad River Hatchery (steelhead produced in this hatchery are not considered part of this DPS but its operation may impact the NC steelhead DPS).

The natural factors of ocean conditions, El Nino events, terrestrial conditions, floods, droughts and fire remain as threats contributing to the threatened status of NC steelhead. Many populations have declined in abundance to levels that are well below low-risk extinction risk abundance targets, and several are, if not extirpated, likely below the high-risk depensation thresholds specified by Spence *et al.* (2008). These populations are at risk from natural stochastic processes, in addition to deterministic threats, that may make recovery of NC steelhead more difficult. As natural populations get smaller, stochastic processes may cause alterations in genetics, breeding structure, and population dynamics that may interfere with the success of recovery efforts and need to be considered when evaluating how populations respond to recovery actions. See Volume 5, Climate Change for more information on how the changing climate may affect NC steelhead.

Please see the NC steelhead 2016 ESA 5-Year Status Review for a more details on the current status of Listing Factor E (NMFS 2016).

Protective Efforts for NC Steelhead

Protective and conservation efforts have been underway for NC steelhead and these efforts have reduced some of the threats and poor conditions for the species. However, these efforts need to increase in spatially and in intensity to have a measurable positive effect on the species. Please see the NC steelhead 2011 and 2016 ESA 5-Year Status Reviews for a more details on protective efforts (NMFS 2011, NMFS 2016).

DPS RECOVERY GOALS, OBJECTIVES AND CRITERIA

Recovery goals, objectives and criteria provide a means by which the public can measure progress in the efforts at recovery and are used to link listing with status reviews and reclassification determinations. We developed eight categories of recovery criteria for the NC steelhead DPS: biological viability, criteria for each of the five listing factors, degree recovery actions have been implemented, and certainty conservation efforts are ameliorating threats.

The goal for this plan is to remove the NC steelhead DPS from the Federal List of Endangered and Threatened Wildlife (50 CFR 17.11; 50 CFR 223.102) due to their recovery. Our vision is to have restored freshwater and estuarine habitats that are supporting self-sustaining, well-distributed and naturally spawning salmonid populations that provide ecological, cultural, social and economic benefits to the people of California.

Recovery plan objectives are to:

1. Reduce the present or threatened destruction, modification, or curtailment of habitat or range;
2. Ameliorate utilization for commercial, recreational, scientific, or educational purposes;
3. Abate disease and predation;
4. Establish the adequacy of existing regulatory mechanisms for protecting NC steelhead now and into the future (*i.e.*, post-delisting);
5. Address other natural or manmade factors affecting the continued existence of NC steelhead; and
6. Ensure NC steelhead status is at a low risk of extinction based on abundance, growth rate, spatial structure and diversity.

BIOLOGICAL RECOVERY CRITERIA

Populations selected for recovery scenarios must achieve the following criteria based on their role in recovery. Populations selected for recovery scenarios in all the diversity strata of the DPS or ESU must meet these criteria in order for the DPS or ESU to meet biological recovery criteria. See Volume 1, Chapter 4 and 5 for more information.

Low Extinction Risk Criteria: For the essential independent populations selected to be viable, the low extinction risk criteria for effective population size, population decline, catastrophic decline, hatchery influence and density-based spawner abundances must be met according to Spence *et al*. (2008) (Table 1) (See Vol. I Chapter 3)

AND

Moderate Extinction Risk Criteria: Spawner density abundance targets have been achieved for Supporting Independent populations

AND

Redundancy and Occupancy Criteria: Spawner density and abundance targets for dependent populations, which are the occupancy goals for each of those populations, have been achieved (See the discussion of Spence *et al*. (2008) in Vol. I, Chapter 3).

AND

NC steelhead summer-run populations must meet effective population size criteria outlined by Spence *et al*. (2008) (Table 1)

The selected populations and associated recovery criteria for NC Steelhead DPS (Also see Table 2 and Table 3):

a. Selected populations in all five Diversity Strata achieving biological recovery criteria;
b. **NC-BR1:** 27 essential independent populations attaining low extinction risk criteria (*i.e.*, Garcia River, Gualala River, Navarro River, Chamise Creek, Outlet Creek, Tomki Creek, Woodman Creek, Larabee Creek, Middle Fork Eel River, North Fork Eel River, Upper Mainstem Eel River, Van Duzen River, Big River, Noyo River, Ten Mile River, Usal Creek, Wages Creek, Maple Creek/Big Lagoon, Bear River, Humboldt Bay Tributaries, Little River (Humboldt County), Mattole River, South Fork Eel River, Mad River (Upper), Mad River (Lower), and Redwood Creek (Upper) and Redwood (Lower) (Humboldt County));
c. **NC-BR2:** Eight supporting independent populations attaining moderate extinction risk criteria (*i.e.*, Brush Creek, Elk Creek, Bell Springs, Bucknell Creek, Dobbyn Creek, Albion River, Cottaneva Creek and Pudding Creek); and
d. **NC-BR3:** 14 dependent populations contributing to redundancy and occupancy criteria (*i.e.*, Schooner Gulch, Soda Creek, Caspar Creek, Guthrie Creek, Oil Creek, Big Creek, Big Flat Creek, Howe Creek, Jackass Creek, Lower Mainstem Eel River, McNutt Gulch, Shipman Creek, Spanish Creek, and Telegraph Creek).
e. **NC-BR4:** 10 independent summer-run steelhead populations expected to meet effective population size criteria (*i.e.*, Redwood Creek, Mad River, South Fork Eel River, Mattole River, Van Duzen River, Larabee Creek, North Fork Eel River, Upper Middle Mainstem Eel River, Middle Fork Eel River, and Upper Mainstem Eel River.)

Table 1: Criteria for assessing the level of risk of extinction for NC steelhead populations. Overall risk is determined by the highest risk score for any category. N_a is total abundance of adult spawners in a year. N_e is effective population size per generation. N_g is total number of spawners for the generation.

Population Characteristic	Extinction Risk		
	High	**Moderate**	**Low**
Extinction risk from population viability analysis (PVA)	$\geq$ 20% within 20 yrs	$\geq$ 5% within 100 yrs but < 20% within 20 yrs	< 5% within 100 yrs
	- or any ONE of the following -	- or any ONE of the following -	- or ALL of the following -
Effective population size per generation *-or-* Total population size per generation	$N_e \leq 50$ *-or-* $N_g \leq 250$	$50 < N_e < 500$ *-or-* $250 < N_g < 2500$	$N_e \geq 500$ *-or-* $N_g \geq 2500$
Population decline	Precipitous decline[a]	Chronic decline or depression[b]	No decline apparent or probable
Catastrophic decline	Order of magnitude decline within one generation	Smaller but significant decline[c]	Not apparent
Spawner density	$N_a/IPkm$[d] ≤ 1	$1 < N_a/IPkm <$ MRD[e]	$N_a/IPkm \geq$ MRD[e]
Hatchery influence[f]	Evidence of adverse genetic, demographic, or ecological effects of hatcheries on wild population		No evidence of adverse genetic, demographic, or ecological effects of hatchery fish on wild population

[a] Population has declined within the last two generations or is projected to decline within the next two generations (if current trends continue) to annual run size $N_a \leq 500$ spawners (historically small but stable populations not included) *or* $N_a > 500$ but declining at a rate of $\geq$10% per year over the last two-to-four generations.

[b] Annual run size N_a has declined to $\leq$ 500 spawners, but is now stable *or* run size $N_a > 500$ but continued downward trend is evident.

[c] Annual run size decline in one generation < 90% but biologically significant (e.g., loss of year class).

[d] *IPkm* = the estimated aggregate intrinsic habitat potential for a population inhabiting a particular watershed (i.e., total accessible km weighted by reach-level estimates of intrinsic potential; see Bjorkstedt et al. [2005] for greater elaboration).

[e] MRD = minimum required spawner density and is dependent on species and the amount of potential habitat available. Figure 5 summarizes the relationship between spawner density and risk for each species.

[f] Risk from hatchery interactions depends on multiple factors related to the level of hatchery influence, the origin of hatchery fish, and the specific hatchery practices employed.

Table 2: NC winter-run steelhead: Diversity Strata, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting. Redwood Creek and Mad River cross two diversity strata and were broken into an upper and lower to reflect this.

Diversity Strata	NC winter-run steelhead populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Northern Coastal	Bear River	I	Essential	107.8	27.2	2,900
	Big Creek	D	Supporting	3.8	6-12	21-44
	Big Flat Creek	D	Supporting	5.9	6-12	33-69
	Guthrie Creek	D	Supporting	9.2	6-12	53-108
	Howe Creek	D	Supporting	13.9	6-12	81-165
	Humboldt Bay Tributaries	I	Essential	203.4	20.0	4,100
	Jackass Creek	D	Supporting	6.9	6-12	39-81
	Little River (Humboldt Co.)	I	Essential	50.0	35.3	1,800
	Lower Mainstem Eel River Tributaries	D	Supporting	166.4	6-12	996-1,995
	Mad River (Lower)*	I	Essential	146.3	21.9	3,200
	Maple Creek/Big Lagoon	I	Essential	71.7	32.3	2,300
	Mattole River	I	Essential	534.4	20.0	10,700
	McNutt Gulch	D	Supporting	11.3	6-12	66-134
	Oil Creek	D	Supporting	10.6	6-12	62-125
	Redwood Creek (Humboldt Co) (Lower)*	I	Essential	161.1	20.0	3,200
	Shipman Creek	D	Supporting	2.3	6-12	12-26
	South Fork Eel River	I	Essential	951.8	20.0	19,000
	Spanish Creek	D	Supporting	1.9	6-12	9-21
	Telegraph Creek	D	Supporting	5.3	6-12	30-62
	Northern Coastal Diversity Stratum Recovery Target					**47,200**
North Mountain Interior	Dobbyn Creek	I	Supporting	47.0	6-12	280-562

	Larabee Creek	I	Essential	86.4	30.2	2,600
	Mad River (Upper)*	I	Essential	289.6	20.0	5,800
	Middle Fork Eel River	I	Essential	472.4	20.0	9,400
	North Fork Eel River	I	Essential	315.7	20.0	6,300
	Redwood Creek (Humboldt Co) (Upper)*	I	Essential	86.2	30.2	2,600
	Upper Mainstem Eel River	I	Essential	317.5	20.0	6,400
	Van Duzen River	I	Essential	312.2	20.0	6,200
	North Mountain Interior Diversity Stratum Recovery Target					**39,300**
Lower Interior	Bell Springs Creek	I	Supporting	18.1	6-12	107-215
	Bucknell Creek	I	Supporting	9.0	6-12	52-106
	Chamise Creek	I	Essential	36.2	37.2	1,300
	Jewett Creek	I	Supporting	16.8	6-12	99-200
	Garcia Creek	D	Supporting	14.1	6-12	83-167
	Outlet Creek	I	Essential	176.0	20.0	3,500
	Soda Creek	D	Supporting	15.7	6-12	92-186
	Tomki Creek	I	Essential	89.5	29.8	2,700
	Woodman Creek	I	Essential	35.0	37.4	1,300
	Lower Interior Diversity Stratum Recovery Target					**9,100**
North-Central Coastal	Albion River	I	Supporting	48.6	6-12	290-581
	Big River	I	Essential	255	20	5,100
	Caspar Creek	D	Essential	12.9	40.4	500
	Cottaneva Creek	I	Supporting	21.9	6-12	129-261
	Noyo River	I	Essential	152.8	21.0	3,200
	Pudding Creek	I	Supporting	23.9	6-12	141-285
	Ten Mile River	I	Essential	171.1	20	3,400
	Usal Creek	I	Essential	27.5	38.4	1,100

	Wages Creek	I	Essential	17.4	39.8	700
	North-Central Coastal Diversity Stratum Recovery Target					**14,000**
Central Coastal	Brush Creek	I	Supporting	21.4	6-12	126-255
	Elk Creek	I	Supporting	34.5	6-12	205-412
	Garcia River	I	Essential	135.4	23.4	3,200
	Gualala River	I	Essential	396.7	20.0	7,900
	Navarro River	I	Essential	387.6	20.0	7,800
	Schooner Gulch	D	Supporting	7.7	6-12	44-90
	Central Coastal Diversity Stratum Recovery Target					**18,900**
	NC Steelhead DPS Recovery Target					**128,200**

Table 3: NC summer-run steelhead: Diversity Strata, Populations, Historical Population Status, and Effective Population Size (N_e). *The Redwood Creek and Mad River populations each occur in two diversity strata (Spence *et al*. 2008). In both watersheds, the location of actual spawning grounds is poorly understood and therefore each will be treated as one population until more information is obtained from monitoring.

Diversity Strata	NC summer-run steelhead populations	Historical Population Status	Effective Population Size
Northern Coastal/ North Mountain Interior	Redwood Creek*	I	$N_e \geq 500$
Northern Coastal/ North Mountain Interior	Mad River*	I	$N_e \geq 500$
Northern Coastal	South Fork Eel River	I	$N_e \geq 500$
Northern Coastal	Mattole River	I	$N_e \geq 500$
North Mountain Interior	Van Duzen River	I	$N_e \geq 500$
North Mountain Interior	Larabee Creek	I	$N_e \geq 500$
North Mountain Interior	North Fork Eel River	I	$N_e \geq 500$
North Mountain Interior	Upper Middle Mainstem	I	$N_e \geq 500$
North Mountain Interior	Middle Fork Eel River	I	$N_e \geq 500$
North Mountain Interior	Upper Mainstem Eel River	I	$N_e \geq 500$

ESA § 4(A)(1) FACTORS RECOVERY CRITERIA

The following are the recovery criteria for the section ESA 4(a)(1) listing factors. The primary metrics for assessing whether each of the listing factor criteria have been achieved will be to utilize the CAP analyses to reassess habitat attribute and threat conditions in the future, and track the implementation of identified recovery actions unless otherwise found unnecessary.

All recovery actions were assigned to a specific section 4(a)(1) listing factor in order to track progress of implementation of actions for each factor. Recovery Action Priorities are assigned to each action step in the implementation table in accordance with NMFS' Interim Recovery Planning Guidance (NMFS 2010) and the NMFS Endangered and Threatened Species Listing and Recovery Priority Guidelines (55 FR 24296) (See Chapter 4 for more information).

Listing Factor A: Present or threatened destruction, modification or curtailment of habitat or range

A1 CAP/Rapid Assessment attribute ratings for:

- **a.** **Essential Populations** found Good or better for all attributes in each Stratum.
- **b.** **Supporting Populations** found Good or better for 50 percent[3] and the remaining rated Fair throughout the DPS/ESU.

A2 All recovery actions have been implemented under Listing Factor A, or the actions are deemed no longer necessary for recovery.

Listing Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

B1 CAP/Rapid Assessment threat ratings for Fishing and Collecting:

- **a.** **Essential and Supporting Populations** found Medium or Low.

[3] The role of supporting populations within the recovery scenario is to provide for redundancy and occupancy across Diversity Stratum. Because of their role, we use lower criteria for Factor A (*i.e.*, 50 percent as Good or better and the remaining as Fair). A "Fair" CAP/rapid assessment rating means that habitat conditions, while impaired to some degree, are functioning. Therefore, at least all habitat conditions are expected to function within these populations, and at least half are expected to be in proper condition (*i.e.*, Good), which NMFS expects will be sufficient for these populations to fulfill their role within the recovery scenario.

B2 All recovery actions have been implemented under Listing Factor B, or the actions are deemed no longer necessary for recovery.

Listing Factor C: Disease, Predation and Competition

C1 CAP/Rapid Assessment threat ratings for Disease, Predation and Competition:

a. **Essential and Supporting Populations** found Medium or Low.

C2 All recovery actions have been implemented under Listing Factor C, or the actions are deemed no longer necessary for recovery.

Listing Factor D: The Inadequacy of Existing Regulatory Mechanisms

D1 CAP/Rapid Assessment threat ratings related to Listing Factor D (see list below):

a. **Essential and Supporting Populations** found Medium or Low.

Listing Factor D Threats

- Agriculture
- Channel Modification
- Fire, Fuel Management and Fire Suppression
- Livestock Farming and Ranching
- Logging and Wood Harvesting
- Mining
- Residential and Commercial Development
- Roads and Railroads
- Water Diversions and Impoundments

D2 All recovery actions have been implemented under Listing Factor D, or the actions are deemed no longer necessary for recovery.

Listing Factor E: Other Natural and Manmade Factors Affecting the Species' Continued Decline

E1 CAP/Rapid Assessment threat ratings for Hatcheries and Aquaculture, Recreational Areas and Activities, and Severe Weather Patterns:

a. **Essential and Supporting Populations** found Medium or Low.

E2 All recovery actions have been implemented under Listing Factor E, or the actions are deemed no longer necessary for recovery.

CONSERVATION EFFORTS

CE1 Formalized conservation efforts applicable to the ESU or DPS have been implemented and are effective in ameliorating any remaining threats associated with the five section 4(a)(1) factors.

PRIORITIZING POPULATIONS FOR RESTORATION AND FOCUS

While immediately working to restore and recover all populations simultaneously would be preferable, the cost to implement such an effort is prohibitive. Instead, initially focusing efforts in fewer watersheds provides the best chance for species recovery. Decisions to focus efforts and funding to specific areas do not imply other areas are less important or not needed for recovery. Rather, decisions to prioritize populations are necessary to ensure efforts are optimizing benefits to fisheries and ecosystem processes across each of the ESU/DPSs. This prioritization protocol was used to identify essential populations, based on a consistent protocol, that are closest to achieving recovery and that are important to the recovery of the overall Diversity Strata.

NOAA Fisheries evaluated all the essential (i.e. must meet low viability criteria) CCC and NC steelhead and CC Chinook salmon populations within the recovery plans using a prioritization framework based on Bradbury et al. (1995). Oregon State Senate President, Bill Bradbury, asked the Pacific Rivers Council for help in assembling a diverse group to create a prioritization process for effective and scientifically-sound watershed protection and restoration. The framework developed provides a common basis from which diverse groups can develop mutually agreed-upon restoration priorities reflecting a strong scientific basis (Bradbury et al. 1995).

The prioritization framework uses three criteria groupings for ranking populations:

1. biological and ecological resources (Biological Importance);
2. watershed integrity and risk (Integrity and Risk); and

3. potential for restoration (Optimism and Potential).

The following tables are the prioritization results for each species. Please see Appendix H for a more detailed discussion of methods and for the scores and supporting information for each population.

Table 4: NC steelhead Restoration and Focus Prioritization Results

Diversity Strata	Northern California Steelhead Populations	Biological & Ecological			Integrity & Risk		Optimism & Potential				Total	Extant Summer Steelhead (+)	Priority #
		CAP Biological Viability (Weighted)	Number of Listed Species	High IP-km	CAP Watershed Characterization	CAP Threats	Public Lands	CCC Coho Focus Population	SONCC Core 1 Population	Monitoring (LCM) Priority			
Northern Coastal	Redwood Creek	4	3	3	2	1	3	0	1	1	18	+	A
	Maple Creek/Big Lagoon	6	2	1	1	2	1	0	0	0	13		B
	Little River	2	3	1	1	2	1	0	0	0	10		B
	Mad River	2	3	3	2	1	3	0	0	1	15	+	A
	Humboldt Bay Tributaries	4	3	2	1	1	2	0	1	1	15		A
	Lower Mainstem Eel River												C
	Howe Creek												C
	Guthrie Creek												C
	Oil Creek												C
	South Fork Eel River	6	3	3	2	1	3	0	1	1	20		A
	Bear River	6	3	2	1	1	1	0	0	0	14		B
	McNutt Gulch												C
	Mattole River	6	3	3	2	1	2	0	0	1	18	+	A
	Spanish Creek												C
	Big Creek												C
	Big Flat Creek												C
	Shipman Creek												C
	Telegraph Creek												C
	Jackass Creek												C
Lower Interior	Jewett Creek												C
	Chamise Creek	2	3	1	3	2	2	0	1	0	14		A
	Bell Springs Creek												C

	Woodman Creek	2	3	1	3	2	3	0	1	0	15		A
	Outlet Creek	2	3	2	1	2	1	0	1	1	13		B
	Garcia Creek												C
	Tomki Creek	2	3	1	2	2	2	0	1	0	13		B
	Soda Creek												C
	Bucknell Creek												C
North Mountain Interior	Van Duzen River	6	3	3	1	1	2	0	1	1	18	+	A
	Larabee Creek	4	3	1	1	2	1	0	1	0	13		B
	Dobbyn Creek												C
	North Fork Eel River	6	3	3	2	2	3	0	0	0	19		A
	Middle Fork Eel River	4	3	3	3	1	3	0	0	1	18	+	A
	Upper Mainstem Eel River	2	3	2	2	1	3	0	0	0	13		B
North Central Coastal	Usal Creek	6	2	1	2	2	1	1	0	0	15		B
	Cottaneva Creek												C
	Wages Creek	2	2	1	2	2	1	1	0	0	11		B
	Pudding Creek												C
	Ten Mile River	4	3	2	1	1	1	1	0	1	14		A
	Noyo River	4	3	2	2	3	2	1	0	1	18		A
	Caspar Creek	4	2	1	2	2	3	1	0	0	15		B
	Big River	2	3	2	1	3	3	1	0	0	15		A
	Albion River												C
Central Coastal	Navarro River	2	3	3	1	2	2	1	0	1	15		A
	Elk Creek												C
	Brush Creek												C
	Garcia River	4	3	2	2	1	1	1	0	1	15		A
	Schooner Gulch												C
	Gualala River	2	3	3	3	1	1	1	0	0	14		B

DPS AND DIVERSITY STRATA RESULTS

All CAP viability and threat tables were assembled for the NC steelhead DPS to evaluate patterns in the ESU across Diversity Strata and populations. Attribute and threat results are discussed first for Diversity Strata followed by results across lifestages for the DPS. A subset of CAP indicators and threat results were evaluated under a climate change scenario and are provided in Appendix B.

DIVERSITY STRATA ATTRIBUTE AND THREAT RESULTS

The delineation of the NC steelhead DPS Diversity Strata was based on environmental and ecological similarities and life history differences between winter run and summer run adult populations. Five strata were identified by Bjorkstedt *et al*. (2005): Northern Coastal, Lower Interior, North Mountain Interior, North-Central Coastal and Central Coastal.

Attribute Results

Across strata, the Lower Interior Diversity Stratum had the highest percentage of Poor or Fair attribute indicator ratings (76%), followed by the North Mountain Interior stratum (72%) (Figure 3). The North-Central Coastal Diversity Stratum received the lowest percentage of Poor or Fair indicator ratings (50%) overall and the Central Coastal stratum had the lowest percentage of Poor indicator ratings (19%). Figure 3 shows the percentage of ratings for Very Good, Good, Fair and Poor for each Stratum in the DPS.

Threat Results

The Northern Coastal Diversity Stratum received the highest percentage of Very High and High threat ratings (31%) followed by the Central Coastal Diversity Stratum (29%) (Figure 4).

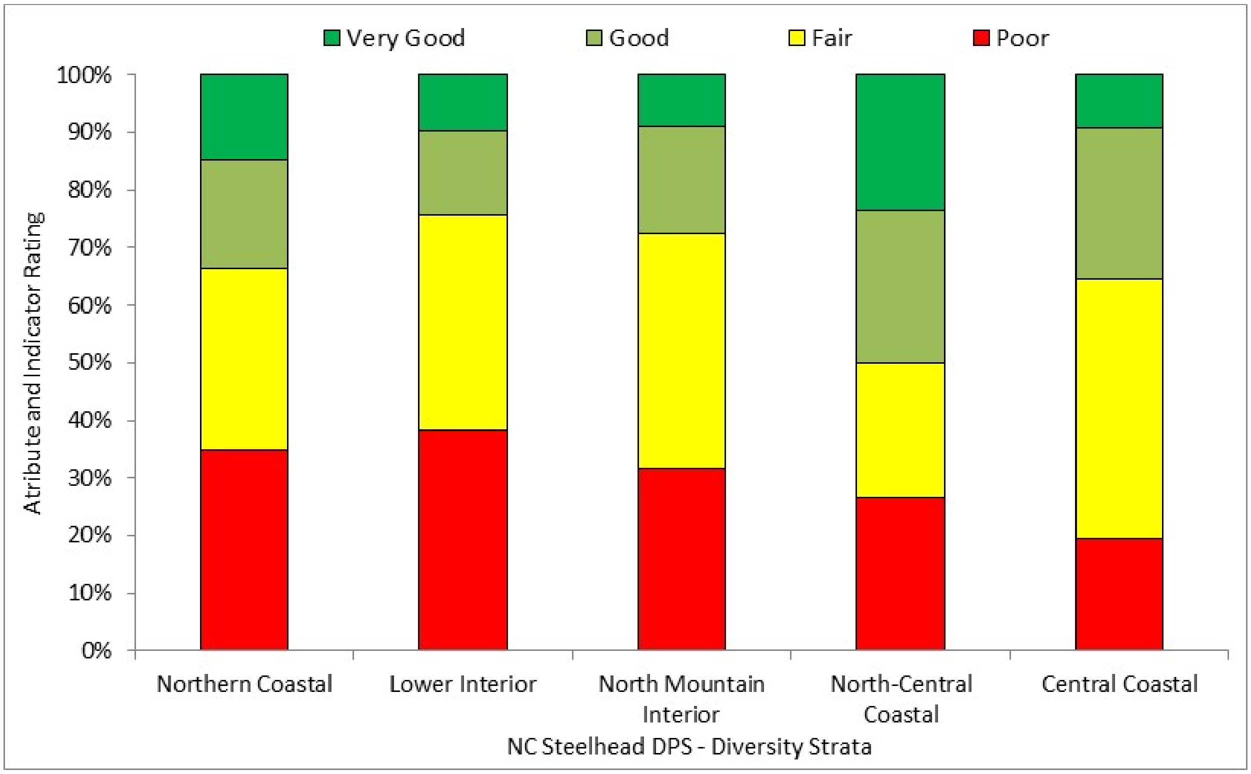

Figure 3: Attribute Indicator ratings for the NC steelhead DPS by Diversity Strata.

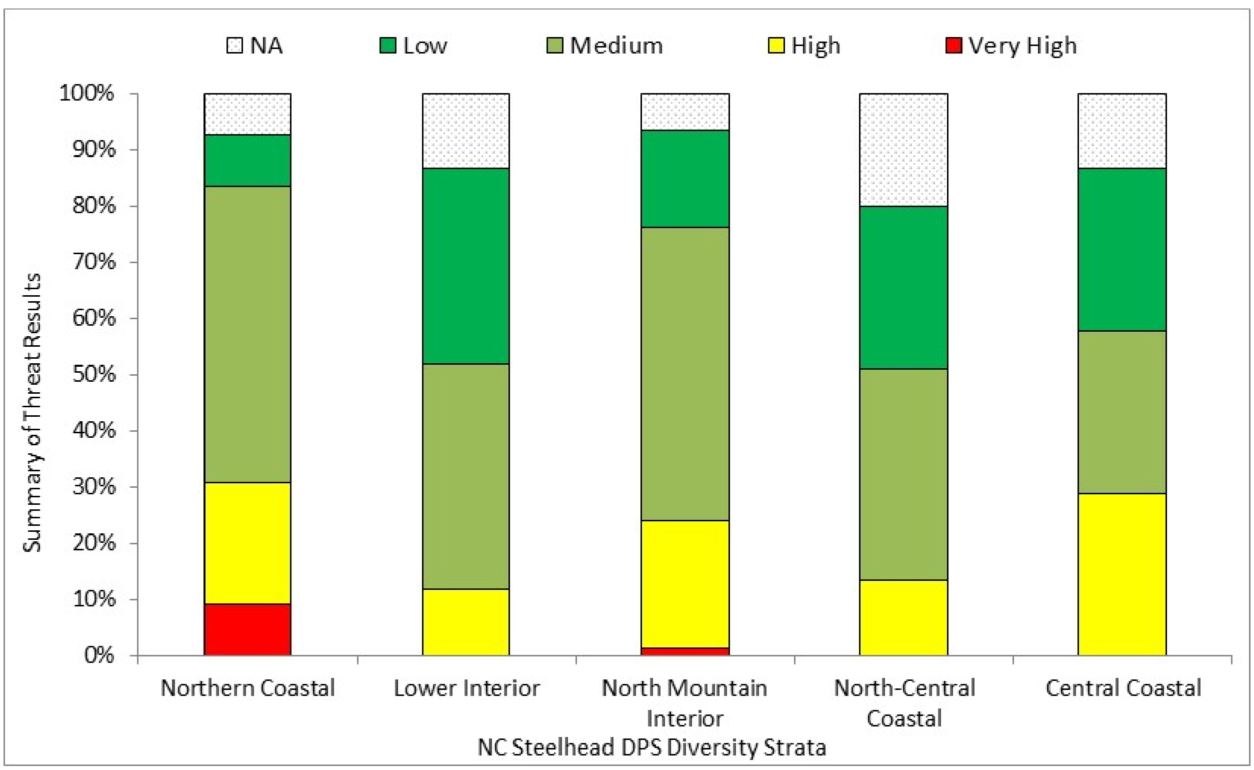

Figure 4: NC steelhead DPS Diversity Strata Threat ratings.

NORTHERN COASTAL DIVERSITY STRATUM RESULTS

The Northern Coastal Diversity Stratum is influenced by the coastal climate conditions of northern California. CAP populations in the Northern Coastal stratum include: Redwood Creek, Maple Creek/Big Lagoon, Little River, Mad River, Humboldt Bay, South Fork Eel River, Bear River, and the Mattole River. Of the five Strata in the DPS, the Northern Coastal has the most extensive urban centers (*i.e.,* Eureka and Arcata), however logging remains the most common and widespread land use.

Attribute Results

The Northern Coastal Diversity Stratum received the second highest percentage of Poor indicator ratings (35%) and a total of 66% of indicators rated as Poor or Fair (Figure 3, Figure 6 and Table 5). In general, attribute indicators of greatest concern for all life stages included estuary/lagoon (quality and extent), indicators related to in-stream habitat complexity (LWD, shelter, pool/riffle/flatwater ratio, percent primary pools), hydrology (number, condition, and/or magnitude of diversions), riparian vegetation (tree diameter), sediment (gravel quality – bulk, spawning gravels), sediment transport (road density and streamside road density), and water quality (turbidity). Indicators of least concern included those associated with hydrology, landscape patterns, passage/migration, and water toxicity (Table 5).

Life Stage Results

In the Northern Coastal stratum, more than 50% of indicator ratings for each life stage were rated as Poor or Fair and more than 60% for five of the six life stages (Figure 5). Winter rearing juveniles were the most impaired life stage with 78% of indicators rated as Poor or Fair followed closely by summer adults with 73%. Half of the indicators for watershed process were rated as either Poor or Fair, of which 34% were rated Poor. Across the stratum, indicators of concern for the winter adult life stage were those associated with a lack of habitat complexity, small riparian tree diameter, sediment (embeddedness), and high turbidity (Table 6). Impaired gravel quantity and quality necessary for successful spawning and egg incubation were the indicators identified as most limiting for the egg life stage. For summer rearing juveniles, winter rearing juveniles, and smolts, impacted estuary/lagoon conditions (summer rearing juveniles and smolts only), and reduced in-stream habitat complexity were common impairments. For summer and winter rearing jueniles, all populations were rated Poor or Fair for riparian vegetation (tree diameter), and in all but one population (Bear River, Fair) winter rearing juveniles were rated Poor for turbidity. Three of four populations with summer adults in the stratum were rated Poor for viability (abundance) with the exception being Mad River (Fair), and habitat complexity (shelter rating) was rated poor in all four populations. All populations were rated Poor or Fair for mainstem water temprature, precent staging pools, and hydrology (baseflow extent) (Table 6).

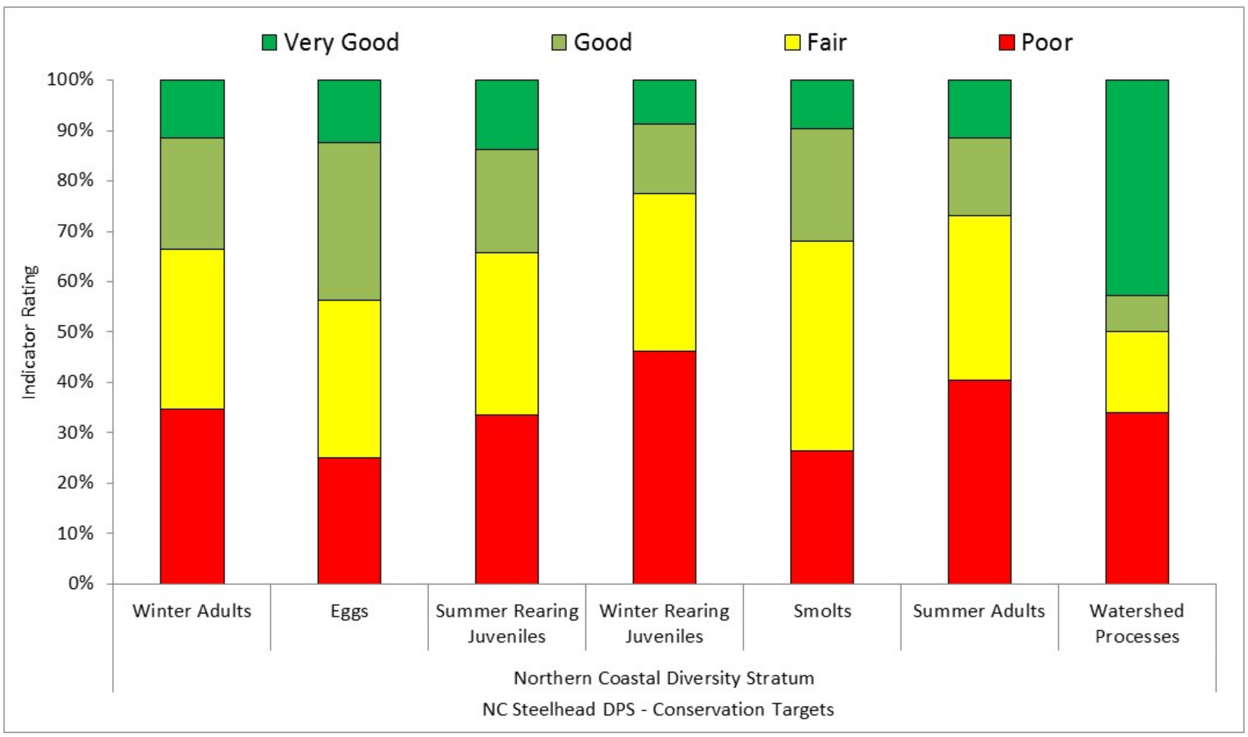

Figure 5: Attribute Indicator Ratings for the Northern Coastal Diversity Stratum Conservation Targets.

Threat Results

Within the stratum, 26% of the threats were rated Very High or High and only 10% were rated Low. Threats of greatest concern were roads and railroads, logging and wood harvesting, channel modification, and water diversions and impoundments (Figure 6 and Table 7). The Mattole River and South Fork Eel River were rated Very High and High respectively for severe weather patterns and for all other populations in the stratum this threat was rated Medium (Table 7). Redwood Creek has the highest amount of Very High and High ratings with 7 out 13 threats assessed rated as Very High or High. The steelhead hatchery on the Mad River is the only extant hatchery operation in the stratum. The remaining populations were not rated for hatcheries and aquaculture.

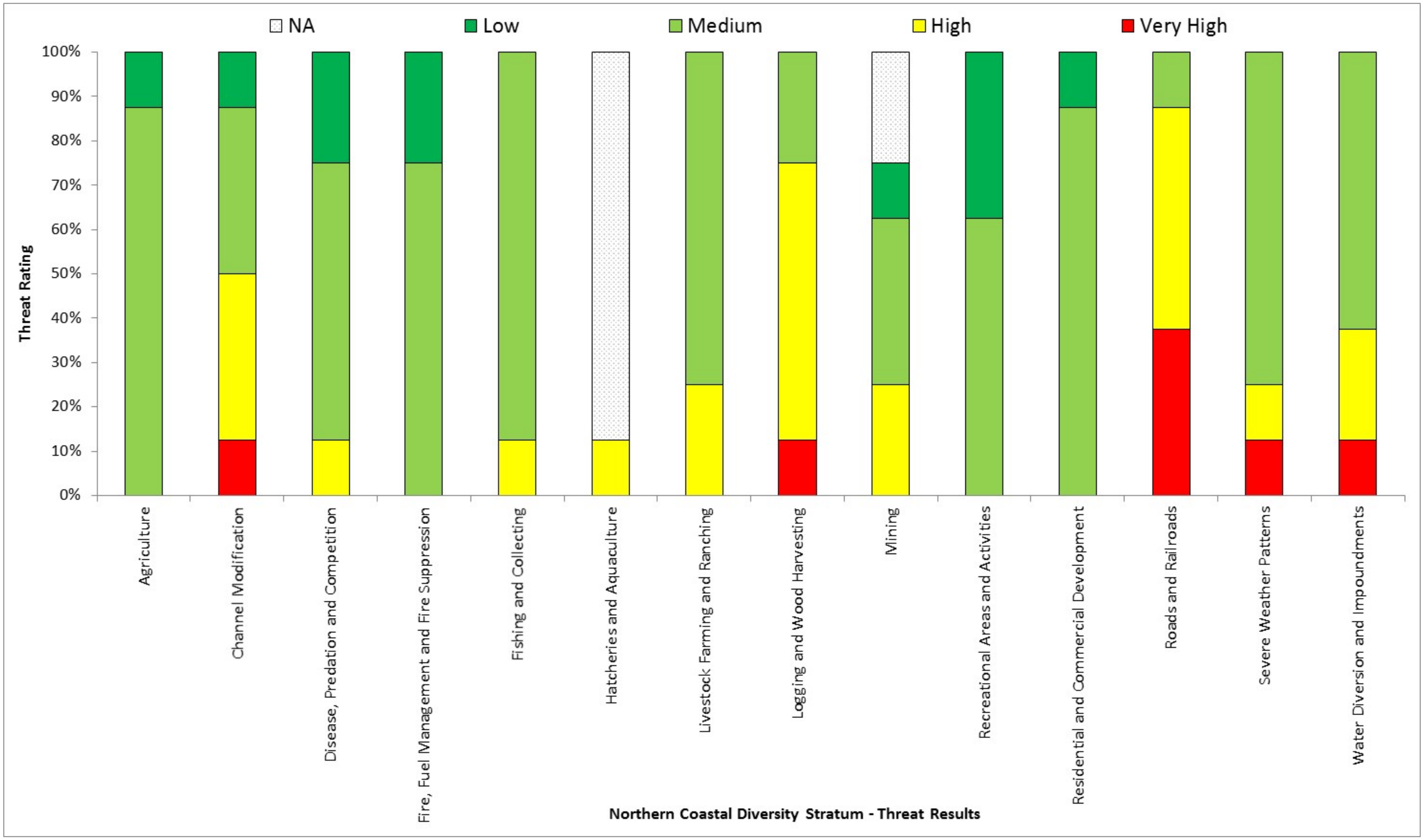

Figure 6: Threat ratings for the Northern Coastal Diversity Stratum.

LOWER INTERIOR DIVERSITY STRATUM RESULTS

The Lower Interior Diversity Stratum consists of four CAP steelhead populations: Chamise, Woodman, Outlet, and Tomki creeks, which drain the interior, mainstem valley of the Eel River Watershed.

Attribute Results

Of the five Diversity Strata, the Lower Interior had the highest percentage (76%) of Poor or Fair indicator ratings and the highest percentage (38%) of Poor ratings alone (Figure 3). Steelhead from each of the four populations in the stratum utilize the same estuary which was rated Poor. Other attribute indicators that were rated Poor or Fair consistently throughout the stratum and across life stages were habitat complexity (large wood frequency, percent primary pools, shelter rating), hydrology (baseflow conditions, instantaneous conditions), riparian vegetation (species composition, tree diameter), gravel quality (embeddedness), sediment transport (streamside road density), and water quality (water temperature, turbidity). Indicators that were less impaired were similar with other strata and included hydrology (impervious surfaces), landscape patterns (agriculture, timber, and urbanization), passage/migration (physical barriers), and water quality (toxicity) (Table 5).

Life Stage Results

The results from the CAP viability analysis indicate each of the target life stages across the stratum are significantly impaired with more than 70% of all attribute indicators rated as Poor or Fair for each life stage (Figure 7 and Table 6). Summer rearing juveniles were the most impacted life stage with 87% of attribute indicators rated as Poor or Fair, followed closely by eggs (81%) and winter rearing juveniles (80%) (Figure 7). Watershed processes overall had 43% of attribute indicators rated as Poor or Fair, and sediment transport (streamside road density) was rated Poor throughout the stratum (Table 6). Attribute indicators of greatest concern for the winter adult life stage are habitat complexity (large wood frequency, pool/riffle/flatwater ratio, shelter rating), riparian vegetation (tree diameter), water quality (turbidity), and viability (density). For eggs, gravel quality (embeddedness) was rated Poor for all populations except Tomki Creek (Fair). In addition to the above indicators for winter adult and egg life stages, estuary/lagoon (quality and extent), hydrology (baseflow and instantaneous flow), water quality (water temperature), and viability (density) were also rated poorly for summer rearing juveniles. Meanwhile, habitat complexity (large wood frequency, shelter), riparian tree diameter, and turbidity appear to be of most concern for the winter rearing juveniles. For smolts, estuary/lagoon, habitat complexity (shelter rating) and viability (low abundance) are most limiting.

Figure 7: Attribute Indicator Ratings for the Lower Interior Diversity Stratum Conservation Targets.

Threat Results

Despite the degraded conditions for all life stages throughout the stratum (see Figure 7), the threat ratings for the stratum were fairly positive with 79% of the threats rated as Low (38%) or Medium (Figure 8 and Table 7). Some threats were deemed not applicable in certain populations in the stratum and therefore were not rated. There are no hatchery or aquaculture programs operating in the stratum and therefore this threat was not rated for all populations in the stratum. None of the threats were rated Very High and those that received a High rating (7%) were roads and railroads and water diversions and impoundments; these are the greatest threat to steelhead within the stratum.

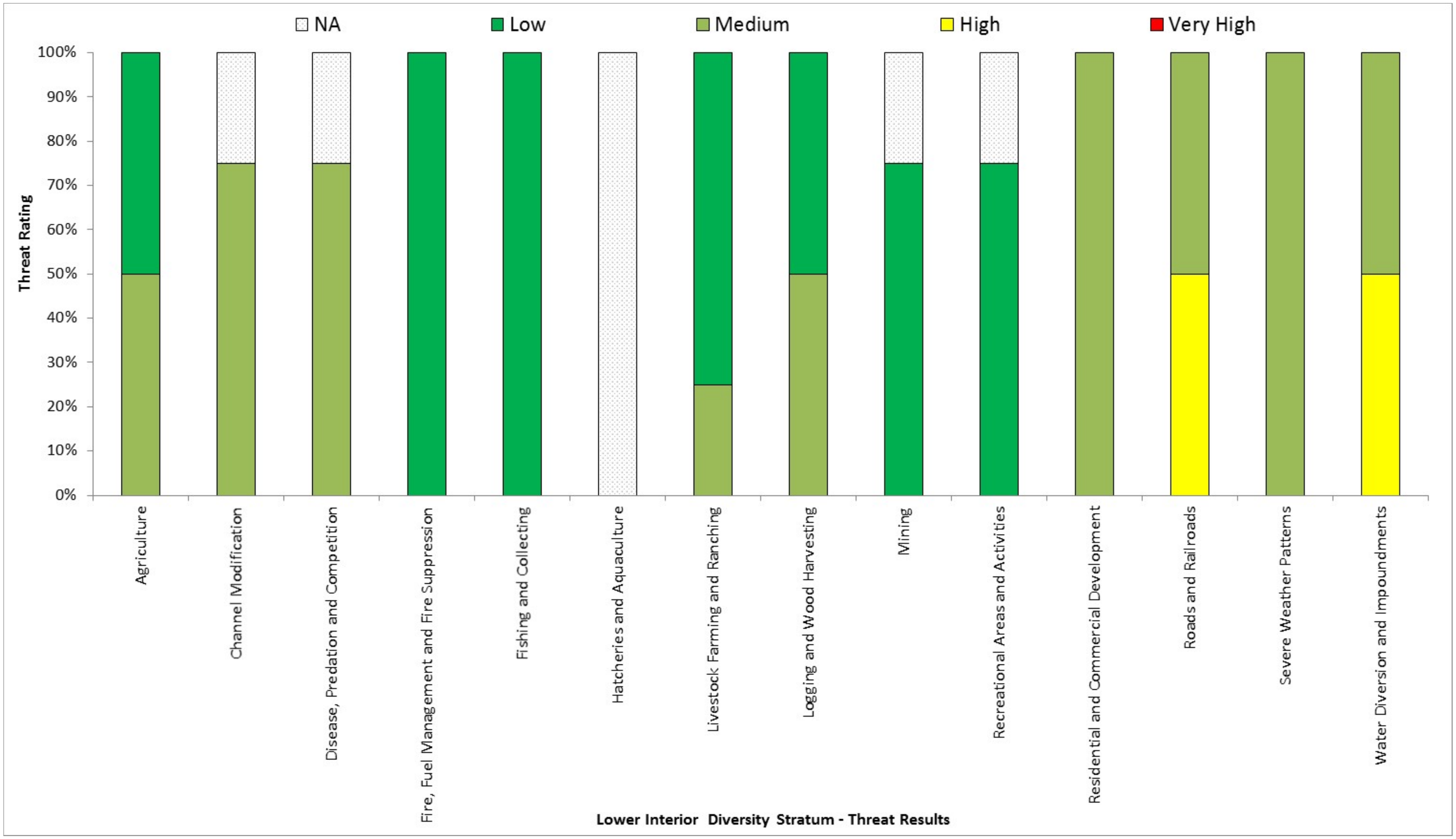

Figure 8: Threat ratings for the Lower Interior Diversity Stratum.

North Mountain Interior Diversity Stratum Results

The North Mountain Interior Diversity Stratum includes populations or parts of populations that occupy areas influenced by likely snowmelt events in the Eel River Watershed. These include the Van Duzen River, Larabee Creek, North Fork Eel River, Middle Fork Eel River, and Upper Mainstem Eel River populations.

Attribute Results

Across strata, the North Mountain Interior had the second highest percentage (72%) of Poor or Fair indicator ratings, of which 32% were rated Poor (Figure 3). Like the other Eel River Watershed populations in the Lower Interior Diversity Stratum, the estuary was rated Poor for all applicable life stages and populations (Table 5). Other attributes with a High percentage of Poor or Fair ratings across the stratum were habitat complexity, riparian vegetation (canopy cover and tree diameter), gravel quality (embeddedness), streamside road density, and water temperatures for summer rearing juveniles (Table 5). Like other strata, most populations and life stages in the North Mountain Interior were rated Fair or better for attribute indicators related to hydrology, landscape patterns, passage/migration, and toxicity (Table 5). The few exceptions were timber harvest (Poor) for the Van Duzen River and Larabee Creek populations, baseflow conditions for summer rearing juveniles and summer adults in the Van Duzen River and North Fork Eel River populations, and passage at mouth or confluence for smolts and summer rearing juveniles in the Upper Mainstem Eel River. Passage (physical barriers) for winter adults and summer adults in the Upper Mainstem Eel River was also rated Poor due to Scott Dam.

Life Stage Results

Across the North Mountain Interior Diversity Stratum, all life stages of steelhead are impaired with more than 60% of attribute indicators rated as Poor or Fair (Figure 9). Based on the percentage of indicators rated as Poor or Fair, summer rearing juveniles (83%) were the most impaired life stage, followed closely by winter rearing juveniles (82%). Summer rearing juveniles received the most Poor ratings overall (40%). As with other strata in the DPS, streamside road density was rated Poor and is the most concerning watershed process in the North Mountain Interior populations. Individual life stage results were similar for other strata. Winter adults are most limited by habitat complexity, riparian vegetation, and to a lesser extent turbidity, and eggs are most limited by gravel embeddedness (Table 6). Estuary/lagoon, habitat complexity, riparian vegetation, sediment, and water temperature are of greatest concern for summer rearing juveniles. Winter rearing juveniles are most limited by reduced habitat complexity, riparian tree diameter, and high gravel embeddedness, and smolts are most impacted by poor estuary/lagoon and in-stream shelter conditions. For summer adults, indicators of greatest concern include percent staging pools, shelter rating, gravel quantity and quality, and high mainstem water temperatures.

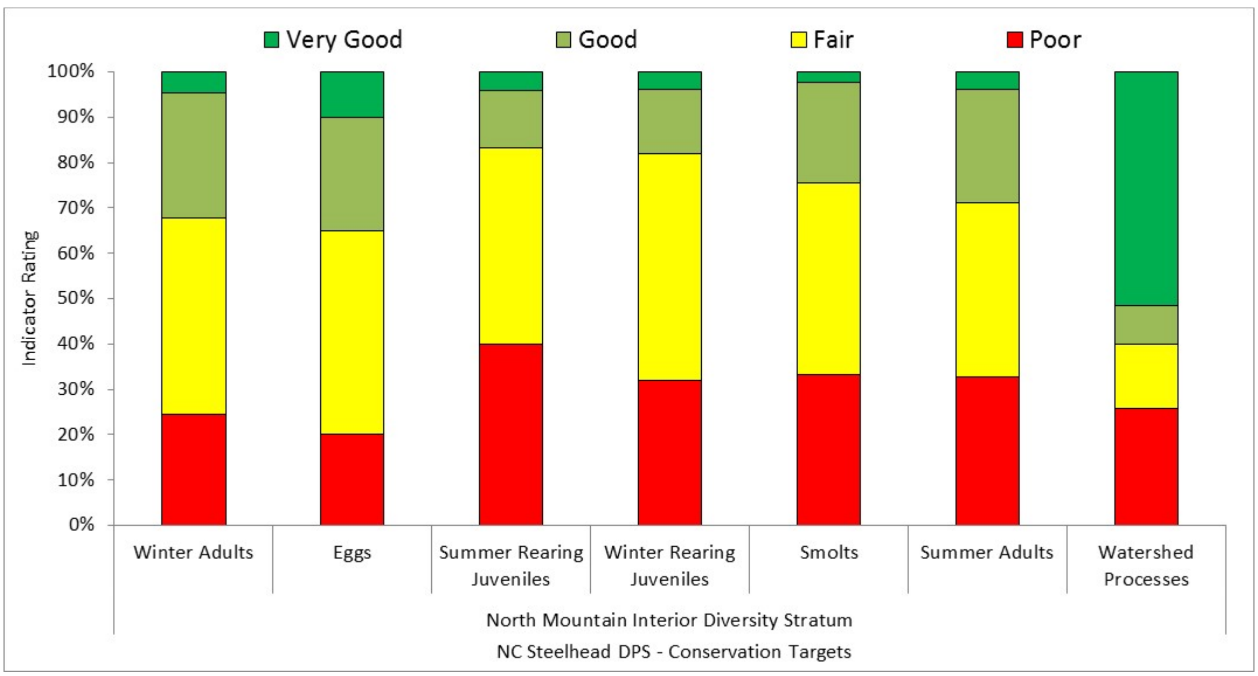

Figure 9: Attribute Indicator Ratings for the North Mountain Interior Diversity Stratum Conservation Targets.

Threat Results

Similar to the Lower Interior stratum, the North Mountain Interior had an overall Low percentage (18%) of High or Very High threats (Figure 10). The only Very High rating for the stratum was water diversion and impoundments in the Upper Mainstem Eel River population (Table 7). Roads and railroads were rated a High threat for all populations in the stratum while hatcheries and aquaculture were rated Low in all populations. There are no steelhead hatcheries in operation within the stratum and therefore these threats were not rated.

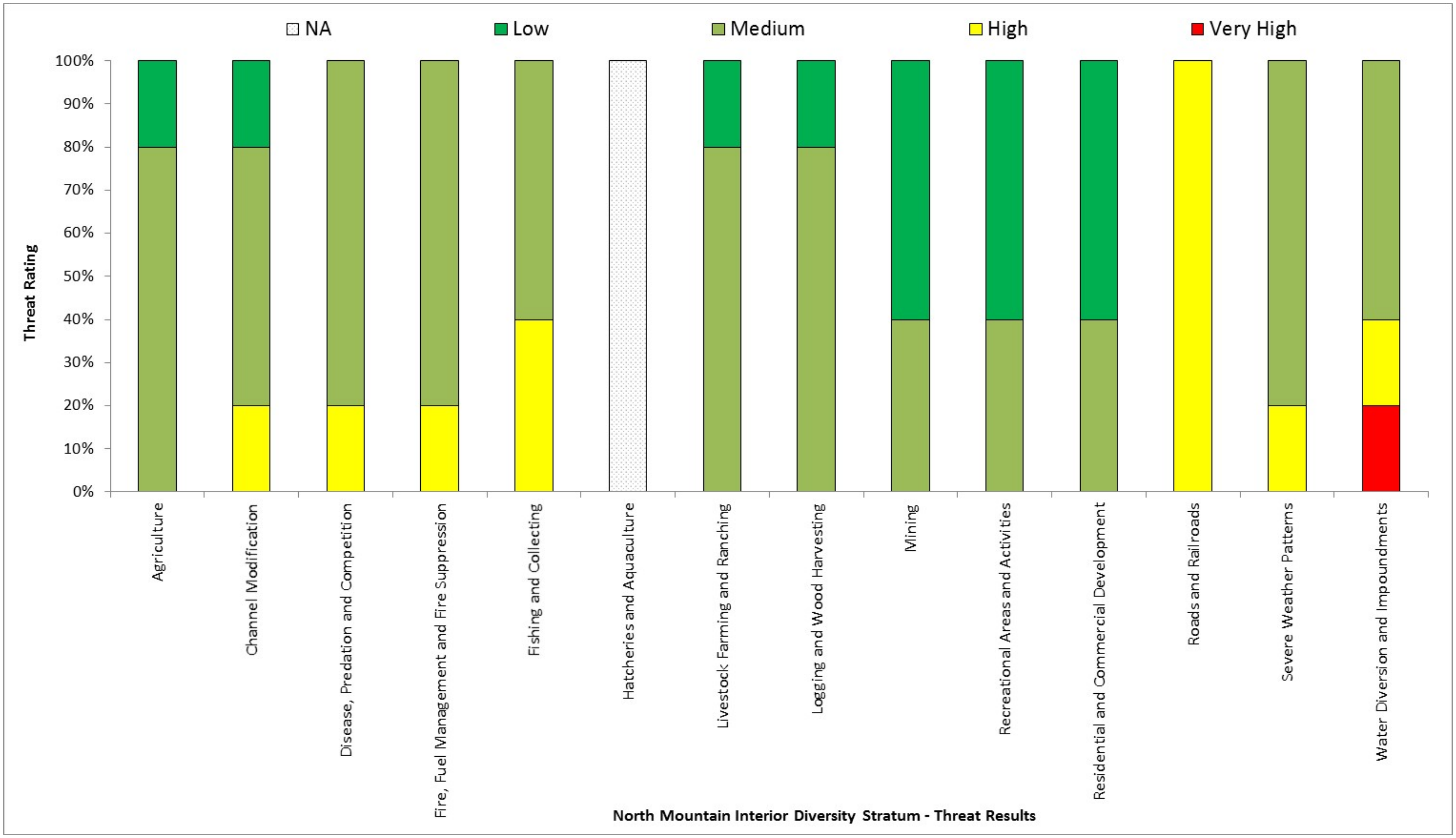

Figure 10: Threat ratings for the North Mountain Interior Diversity Stratum.

NORTH-CENTRAL COASTAL DIVERSITY STRATUM RESULTS

The North-Central Coastal Diversity Stratum CAP populations occur along the Mendocino County coastline and include Usal Creek, Wages Creek, Ten Mile River, Noyo River, Caspar Creek, and Big River. This stratum is comprised almost entirely of a forested landscape, and timber harvest is the dominant land use. Small coastal and rural developments also exist.

Attribute Results

Based on the CAP viability results, the North-Central Coastal Diversity Stratum was the least impaired in the DPS (Figure 3); however 50% of indicator ratings for the stratum were reported as Poor or Fair. With the exception of Usal Creek, indicator ratings for estuary/lagoon quality and extent were better than the Eel River populations to the north, and two of six of the populations were rated Good for summer rearing juveniles (Table 5). As in other strata, habitat complexity was identified as a serious impairment for steelhead viability with the exception of Caspar Creek which was rated Good or Very Good for large wood frequency and pool/riffle/flatwater ratio. Road density, including streamside roads, was rated Poor for all populations. With very few exceptions, all attribute indicators related to hydrology, landscape patterns, passage/migration, and water quality (toxicity) were rated Good or Very Good for all life stages and populations in the stratum.

Life Stage Results

In the North-Central Coastal Diversity Stratum, winter rearing juveniles are the most impacted life stage with 67% of indicators rated as Poor or Fair (Figure 11). This result is consistent with the relatively poor habitat complexity (*i.e.,* poor overwintering habitat quality) reported for most of the stratum. For winter adults, large wood frequency was rated Poor or Fair in all populations except for Caspar Creek (Very Good and Good), and shelter rating was Poor or Fair for all populations in the stratum (Table 6). Most indicators were rated Fair or better for the egg life stage with the few exceptions related to gravel quantity (Usal and Wages Creeks) and quality (Ten Mile and Big Rivers) (Table 6). Like winter rearing juveniles and winter adults, indicators of most concern for the summer rearing juvenile life stage were those associated with habitat complexity as well as sediment quality and water temperature. For smolts, all populations in the stratum were rated Poor for habitat complexity (shelter rating) except one (Wages Creek, Fair). Viability (low abundance) was also a concern for the smolt life stage throughout in the stratum. With the exception of road density throughout and timber harvest in the Ten Mile River, all other indicators for watershed processes were rated Fair or better with a majority rated as Very Good.

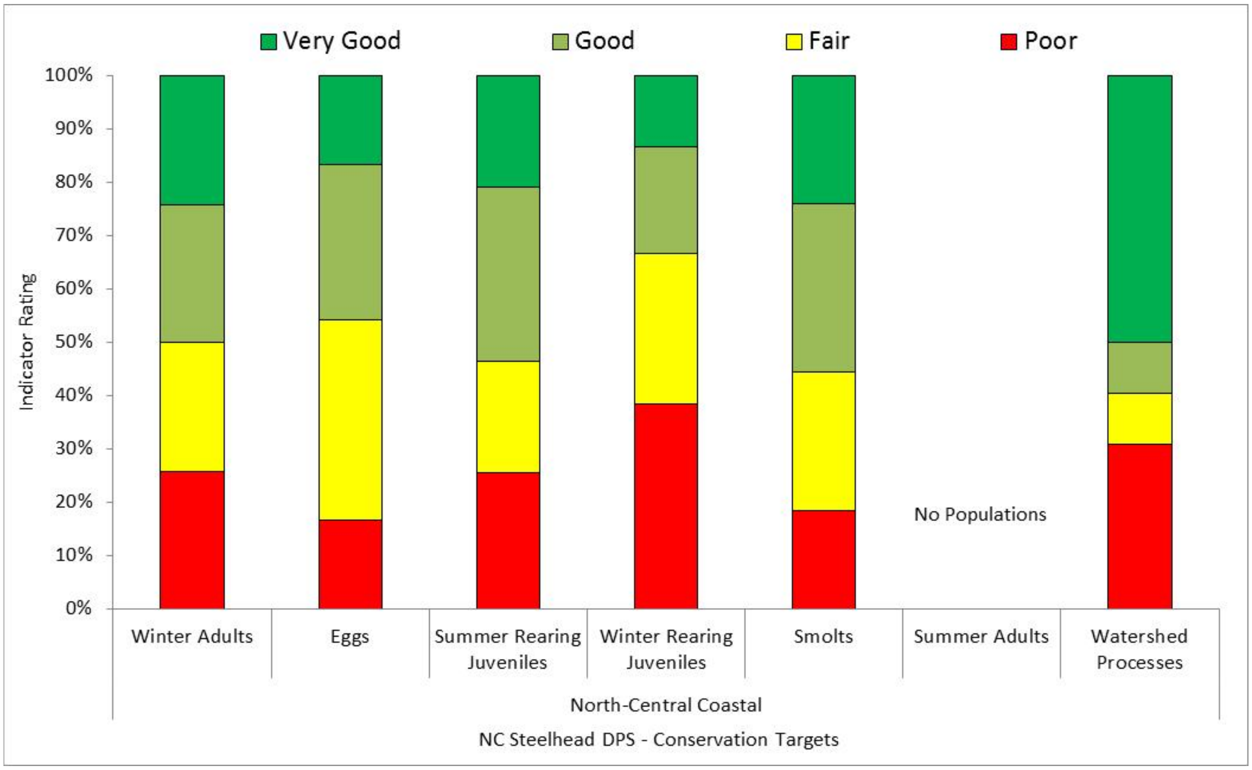

Figure 11: Attribute Indicator Ratings for the North-Central Coastal Diversity Stratum conservation targets.

Threat Results

As in other strata, roads and railroads represent the greatest threat to steelhead and their designated critical habitat in the North-Central Diversity Stratum (Figure 12). There were no threats rated Very High and only 10% of threats were rated High. Severe weather patterns was rated High in two populations (Usal and Ten Mile) (Table 7).

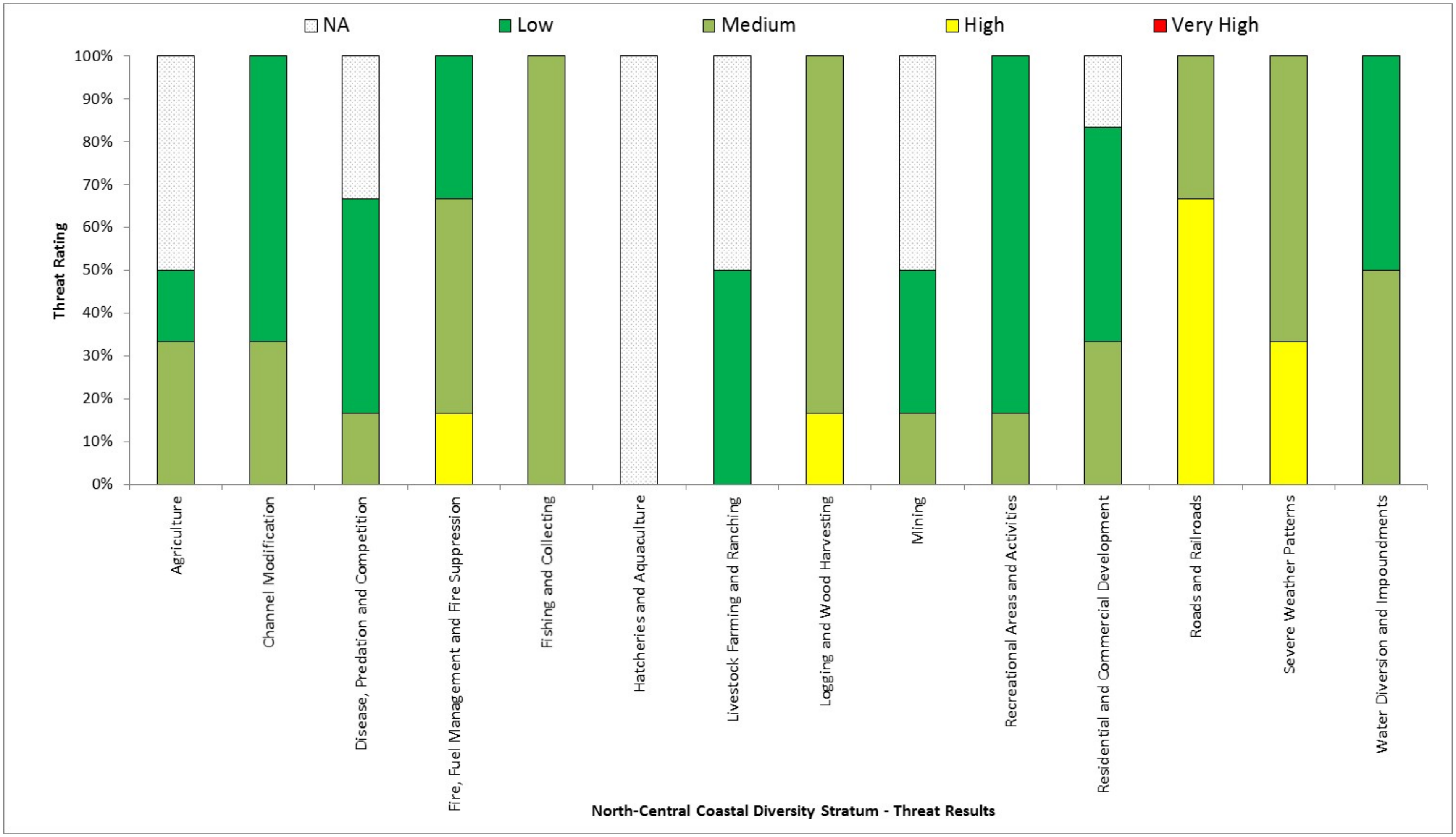

Figure 12: Threat ratings for the North-Central Coastal Diversity Stratum.

CENTRAL COASTAL DIVERSITY STRATUM RESULTS

The Central Coastal Diversity Stratum CAP populations are Navarro River, Garcia River, and the Gualala River, located in northern Sonoma and southern Mendocino counties. These populations are largely covered by a forested landscape where logging is a common land use. Agriculture and small rural developments also exist and are becoming more common.

Attribute Results

The Central Coastal Diversity Stratum had the fewest indicators rated Poor overall (19%), however 65% of indicators were rated Poor or Fair (Figure 3). Estuary conditions were rated Fair or better for all life stages and populations (Table 5). Shelter rating was rated Poor across all three populations, while percent primary pools, and pool/riffle/flatwater ratio were rated Poor for all lifestages in two of three populations (Navarro and Gualala). Large wood frequency in the channel was generally rated Good for two of the three populations (Garcia and Gualala rivers) and Poor in the Navarro River. Like other strata, streamside road density was rated Poor or Fair for all populations and flow conditions, and viability (density) and water temperature were rated Poor or Fair for summer rearing juveniles.

Life Stage Results

Based on the combined percentage of Poor and Fair indicator ratings, smolts (78%, 7% as Poor) are the most impaired life stage in the Central Coastal Diversity Stratum; although winter rearing juveniles (27%), summer rearing juveniles (25%), and winter adults (19%) received a higher percentage of Poor ratings overall (Figure 13). The high percentage of Poor ratings for the summer rearing and winter rearing juveniles were largely due to impaired habitat complexity (Table 6). A majority of the indicator ratings for the egg life stage were rated Fair which indicates gravel quality and quantity throughout the stratum are not primary limiting factors. Winter adults and smolts are most impaired by Poor shelter, particularly in the Garcia and Gualala river populations and large wood frequency was rated Poor for winter adults in the Navarro River population.

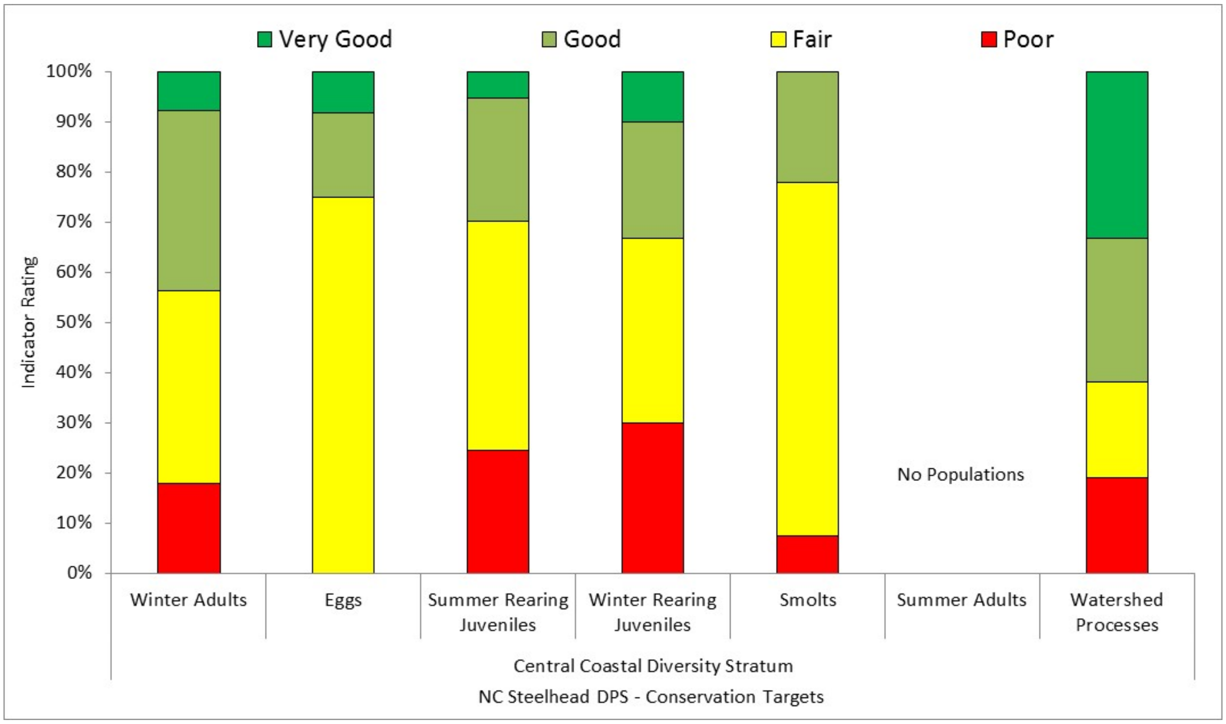

Figure 13: Attribute Indicator Ratings for the Central Coastal Diversity Stratum Conservation Targets.

Threat Results

Water diversions or impoundments for all three populations were rated High and were identified as the most significant threat to steelhead in the stratum (Figure 14 and Table 7). Roads and railroads as well as logging and wood harvesting were also rated as High threats for the Garcia and Gualala populations and Medium threats for the Navarro population.

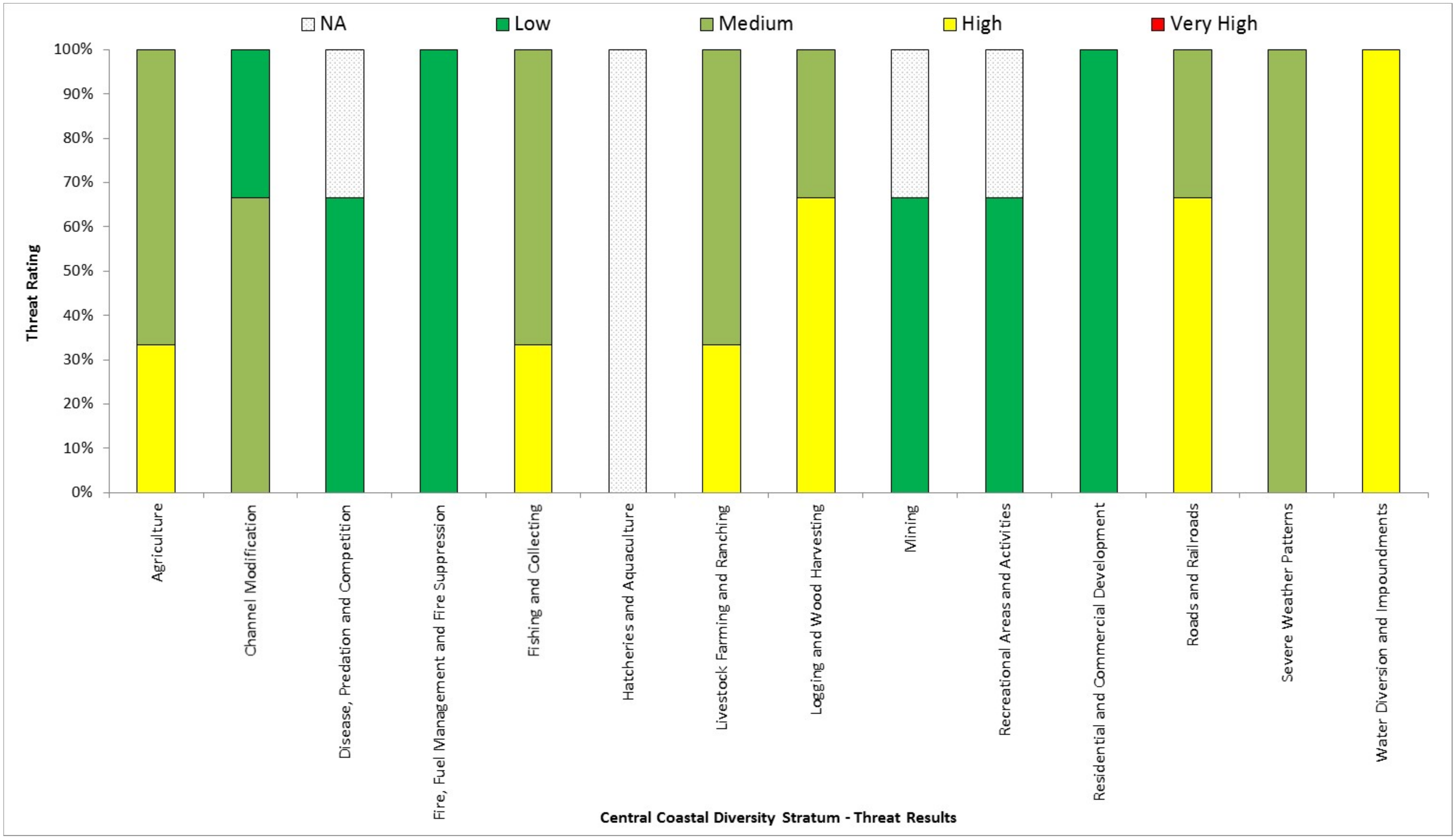

Figure 14: Threat ratings for the Central Coastal Diversity Stratum.

DPS CAP VIABILITY RESULTS

Attributes

Throughout the DPS and across life stages, attribute indicators most impacted are those associated with habitat complexity (large wood frequency, percent primary pools, pool/riffle/flatwater ratio, and shelter), riparian vegetation (tree diameter), and sediment transport (road density, streamside road density) (Table 5). The quality and extent of estuarine habitat for summer rearing juvenile and smolt life stages were rated Poor for all ten steelhead populations within the Eel River Watershed, and was rated Poor or Fair for most other populations throughout the DPS. Hydrology (flow conditions, impervious surfaces, number and magnitude of diversion, and passage flows), passage/migration (passage at mouth or confluence, physical barriers), landscape patterns (agriculture and urbanization), and water quality (toxicity) are the least impacted attribute indicators across the DPS and life stages (Table 5).

Table 5: NC steelhead DPS CAP Viability Summary by Attribute.

NC Steelhead Population Conditions By Habitat Attribute			Northern Coastal								Lower Interior				North Mountain Interior					North-Central Coastal						Central Coastal		
Target	Attribute	Indicator	Redwood	Maple Creek/Big Lagoon	Little River	Mad River	Humbold Bay	South Fork Eel River	Bear River	Mattole River	Chamise Creek	Woodman Creek	Outlet Creek	Tomki Creek	Van Duzen River	Larabee Creek	North Fork Eel River	Middle Fork Eel River	Upper Mainstem Eel River	Usal Creek	Wages Creek	Ten Mile River	Noyo River	Caspar Creek	Big River	Navarro River	Garcia River	Gualala River
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	P	F	F	F	P	F	F	P	P	P	P	P	P	P	P	P	P	F	G	F	G	F	F	G	F
Smolts	Estuary/Lagoon	Quality & Extent	P	P	F	F	F	P	F	F	P	P	P	P	P	P	P	P	P	P	F	G	F	F	F	F	F	F
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	F	P	F	P	F	P	P	F	P	P	P	F	F	F	P	P	P	P	P	P	V	P	P	G	G
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	F	P	F	P	F	P	P	F	P	P	P	F	F	F	P	P	P	P	P	P	V	P	P	G	G
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	F	P	F	P	F	P	P	F	P	P	P	F	F	F	P	P	P	P	P	P	V	P	P	G	G
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	F	P	F	F	P	P	P	P	P	P	P	F	F	F	P	P	P	F	P	P	G	P	P	F	G
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	F	P	F	F	P	P	P	P	P	P	P	F	F	F	P	P	P	F	P	P	G	P	P	F	G
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	F	P	F	P	P	P	P	P	P	P	P	F	F	F	P	P	P	F	P	P	G	P	P	F	G
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	F	P	F	P	P	F	G	F	F	P	P	P	P	F	P	P	P	P	P	P	F	P	P	P	G	P
Summer Adults	Habitat Complexity	Percent Staging Pools	P	NA	NA	F	NA	F	NA	P	NA	NA	NA	NA	P	NA	P	G	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	P	P	V	P	F	F	P	F	F	V	F	P	F	F	P	P	F	F	F	G	F	V	P	F	G	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	P	P	P	P	F	F	P	F	F	V	F	P	F	F	P	P	P	F	P	G	F	V	P	P	G	P
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	P	P	P	P	F	F	P	F	F	V	F	P	F	F	P	P	F	F	F	G	F	V	P	P	G	P
Winter Adults	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	F	P	P	F	P	F	P	P	P	P	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	P	P	P	F	P	F	P	P	P	P	P	P	P
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	F	P	P	F	P	F	P	P	P	P	P	P	P
Smolts	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	F	P	P	P	P	F	P	P	P	P	F	P	P
Summer Adults	Habitat Complexity	Shelter Rating	P	NA	NA	P	NA	P	NA	P	NA	NA	NA	NA	P	NA	P	P	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	P	G	G	F	F	P	G	P	F	F	P	P	P	F	P	F	G	G	G	V	G	G	F	F	F	P
Summer Adults	Hydrology	Flow Conditions (Baseflow)	F	NA	NA	F	NA	P	NA	F	NA	NA	NA	NA	P	NA	P	G	G	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	F	G	G	G	V	G	G	G	F	F	G	G	G	V	V	G	G	V	G	V	G	V	G	F	F	F
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	F	G	G	G	V	F	F	P	F	F	P	F	F	F	F	F	F	G	G	V	G	V	G	F	F	P
Watershed Processes	Hydrology	Impervious Surfaces	V	V	V	V	F	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	P	V	G	F	P	P	G	P	V	G	P	F	P	F	G	F	F	V	F	F	V	V	G	F	G	G
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	P	V	G	F	P	F	G	F	V	G	F	F	P	F	G	G	G	V	F	G	V	V	G	F	G	G
Winter Adults	Hydrology	Passage Flows	G	V	V	G	V	G	G	F	F	F	F	G	G	G	G	G	G	V	G	V	V	V	G	F	F	G
Smolts	Hydrology	Passage Flows	F	V	V	G	V	F	G	F	F	G	F	G	F	F	P	G	G	V	G	G	G	V	G	F	F	F
Summer Adults	Hydrology	Passage Flows	F	NA	NA	G	NA	F	NA	F	NA	NA	NA	NA	P	NA	G	G	G	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eggs	Hydrology	Redd Scour	F	V	V	G	P	F	G	F	F	F	G	F	F	F	G	F	F	F	G	G	F	V	F	F	F	G
Watershed Processes	Landscape Patterns	Agriculture	V	V	V	V	V	V	V	V	V	V	F	V	F	G	V	V	V	V	V	V	V	V	V	F	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	V	F	P	G	P	G	G	V	V	V	G	V	P	P	V	V	V	G	F	P	F	V	F	G	G	F
Watershed Processes	Landscape Patterns	Urbanization	V	V	V	V	P	V	V	V	V	V	F	F	V	V	V	V	V	V	V	V	V	V	V	G	V	V
Winter Adults	Passage/Migration	Passage at Mouth or Confluence	G	V	G	G	G	G	V	G	G	G	F	G	G	G	G	G	G	G	V	V	V	V	V	G	F	G
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	G	V	G	G	G	P	V	P	F	G	F	F	F	G	F	F	P	G	V	V	G	V	G	F	F	F
Smolts	Passage/Migration	Passage at Mouth or Confluence	G	V	G	G	G	F	V	F	G	G	G	F	F	G	F	G	P	P	G	V	V	V	G	G	F	F
Summer Adults	Passage/Migration	Passage at Mouth or Confluence	F	NA	NA	G	NA	P	NA	F	NA	NA	NA	NA	F	NA	G	G	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Adults	Passage/Migration	Physical Barriers	V	V	G	V	G	V	V	V	V	P	F	V	V	V	V	G	P	V	V	V	V	V	G	G	V	V
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	G	V	G	V	V	V	V	F	P	V	G	V	V	G	F	V	V	V	V	V	G	F	V	V
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	G	V	G	V	V	V	G	G	F	V	G	V	V	G	F	V	V	V	G	V	V	F	V	V
Summer Adults	Passage/Migration	Physical Barriers	V	NA	NA	V	NA	V	NA	V	NA	NA	NA	NA	V	NA	F	F	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	F	F	G	V	V	F	P	F	P	V	F	P	P	P	P	F	F	G	V	F	V	V	P	F	F	F
Watershed Processes	Riparian Vegetation	Species Composition	F	F	F	F	G	F	P	F	F	F	F	F	V	G	F	G	F	V	V	G	G	G	F	P	F	G
Winter Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	F	F	F	P	P	F	F	P	P	P	F	P	P	P	F	F	P	P	F	G	F	P	F	F
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	F	F	F	P	P	F	F	P	P	P	F	P	P	P	F	F	P	P	F	G	F	P	F	F
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	F	F	F	P	P	F	F	P	P	P	F	P	P	P	F	F	P	P	F	G	F	P	F	F
Eggs	Sediment	Gravel Quality (Bulk)	F	P	F	V	P	P	F	P	F	F	F	F	P	G	F	P	F	P	P	F	F	F	F	F	F	G
Summer Adults	Sediment	Gravel Quality (Bulk)	F	NA	NA	V	NA	P	NA	P	NA	NA	NA	NA	P	NA	F	P	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eggs	Sediment	Gravel Quality (Embeddedness)	G	P	P	F	F	F	G	P	P	P	P	F	P	F	F	P	F	F	G	P	F	G	P	F	V	F
Summer Adults	Sediment	Gravel Quality (Embeddedness)	G	NA	NA	V	NA	F	NA	P	NA	NA	NA	NA	P	NA	F	P	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Adults	Sediment	Quantity & Distribution of Spawning Gravels	P	P	F	G	F	G	P	P	F	P	G	G	P	F	F	G	G	V	G	G	G	V	G	G	F	V
Summer Adults	Sediment	Quantity & Distribution of Spawning Gravels	P	NA	NA	G	NA	G	NA	P	NA	NA	NA	NA	P	NA	F	G	G	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	V	F	F	G	P	P	P	F	F	P	F	F	P	P	F	G	P	F	F	P	F	V	F
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	V	F	F	G	P	P	P	F	F	P	F	F	P	P	F	P	P	F	F	P	F	V	F
Watershed Processes	Sediment Transport	Road Density	P	P	P	P	P	P	P	F	G	G	F	G	P	P	F	V	F	P	P	P	P	P	P	P	G	G
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F
Smolts	Smoltification	Temperature	P	F	V	F	G	P	F	P	F	G	F	F	F	G	P	F	F	V	V	V	G	V	G	F	G	F
Winter Adults	Velocity Refuge	Floodplain Connectivity	P	F	G	G	F	F	F	P	F	G	P	G	F	G	G	F	F	G	G	F	F	F	F	G	P	F
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	P	F	G	G	F	F	F	P	G	G	P	F	F	G	G	F	G	G	G	F	F	P	F	F	P	F
Summer Adults	Velocity Refuge	Floodplain Connectivity	P	NA	NA	G	NA	F	NA	P	NA	NA	NA	NA	F	NA	G	F	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Smolts	Viability	Abundance	F	G	P	F	F	G	F	F	F	P	F	P	F	F	F	F	P	F	P	F	F	P	F	F	F	F
Summer Adults	Viability	Abundance	P	NA	NA	F	NA	P	NA	P	NA	NA	NA	NA	F	NA	P	F	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Adults	Viability	Density	F	G	P	F	F	F	G	F	P	F	F	P	F	F	G	F	P	F	P	F	F	F	P	F	F	F
Summer Rearing Juveniles	Viability	Density	F	G	P	F	F	F	F	G	P	P	F	P	F	F	F	F	F	G	F	F	F	G	F	F	F	P
Summer Rearing Juveniles	Viability	Spatial Structure	G	V	F	F	G	V	V	V	V	G	F	P	G	V	G	F	P	V	G	V	G	G	G	F	G	G
Summer Adults	Water Quality	Mainstem Temperature (MWMT)	P	NA	NA	F	NA	P	NA	P	NA	NA	NA	NA	F	NA	P	F	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	P	V	V	V	V	P	P	F	P	F	P	P	F	P	P	F	P	G	V	F	P	F	P	P	F	F
Winter Adults	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	G	F	G	G	F	F	V	G	G	G	G	G	F	G	F
Summer Rearing Juveniles	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	F	F	G	G	F	V	G	G	G	G	G	G	F	G	F
Winter Rearing Juveniles	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	G	F	G	G	F	F	V	G	G	G	G	G	F	G	F
Smolts	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	G	F	G	G	F	V	V	G	G	G	G	G	F	G	F
Summer Adults	Water Quality	Toxicity	F	NA	NA	G	NA	F	NA	G	NA	NA	NA	NA	F	NA	G	G	V	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Adults	Water Quality	Turbidity	P	P	P	F	P	P	F	P	P	F	F	F	P	F	F	F	F	F	G	P	G	F	F	G	G	G
Summer Rearing Juveniles	Water Quality	Turbidity	G	P	P	G	G	P	G	F	F	F	F	F	P	G	G	G	F	G	G	G	G	G	V	G	G	G
Winter Rearing Juveniles	Water Quality	Turbidity	P	P	P	P	P	P	F	P	P	F	F	F	P	F	F	F	F	F	G	P	F	P	F	G	G	F
Smolts	Water Quality	Turbidity	P	P	P	F	P	F	F	F	F	F	F	F	P	F	F	F	F	F	G	P	F	F	F	F	G	F

Table 6: NC steelhead DPS CAP Viability Summary by Conservation Target.

NC Steelhead Population Conditions By Target Life Stage			Northern Coastal								Lower Interior				North Mountain Interior					North-Central Coastal						Central Coastal		
Target	Attribute	Indicator	Redwood	Maple Creek/Big Lagoon	Little River	Mad River	Humboldt Bay	South Fork Eel River	Bear River	Mattole River	Chamise Creek	Woodman Creek	Outlet Creek	Tomki Creek	Van Duzen River	Larabee Creek	North Fork Eel River	Middle Fork Eel River	Upper Mainstem Eel River	Usal Creek	Wages Creek	Ten Mile River	Noyo River	Caspar Creek	Big River	Navarro River	Garcia River	Gualala River
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	F	P	F	P	F	P	P	F	P	P	P	F	F	F	P	P	P	P	P	P	V	P	P	G	G
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	F	P	F	F	P	P	P	P	P	P	P	F	F	F	P	P	P	F	P	P	G	P	P	F	G
Winter Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	P	P	V	P	F	F	P	F	F	V	F	P	F	F	P	P	F	F	F	G	F	V	P	F	G	P
Winter Adults	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	F	P	P	F	P	F	P	P	P	P	F	P	P
Winter Adults	Hydrology	Passage Flows	G	V	V	G	V	G	G	F	F	F	F	G	G	G	G	G	G	V	G	V	V	V	G	F	F	G
Winter Adults	Passage/Migration	Passage at Mouth or Confluence	G	V	G	G	G	G	V	G	G	G	F	G	G	G	G	G	G	G	V	V	V	V	V	G	F	G
Winter Adults	Passage/Migration	Physical Barriers	V	V	G	V	G	V	V	V	V	P	F	V	V	V	V	G	P	V	V	V	V	V	G	G	V	V
Winter Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	F	F	F	P	P	F	F	P	P	P	F	P	P	P	F	F	P	P	F	G	F	P	F	F
Winter Adults	Sediment	Quantity & Distribution of Spawning Gravels	P	P	F	G	F	G	P	P	F	P	G	G	P	F	F	G	G	V	G	G	G	V	G	G	F	V
Winter Adults	Velocity Refuge	Floodplain Connectivity	P	F	G	G	F	F	F	P	F	G	P	G	F	G	G	F	F	G	G	F	F	F	F	G	P	F
Winter Adults	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	G	F	G	G	F	F	V	G	G	G	G	G	F	G	F
Winter Adults	Water Quality	Turbidity	P	P	P	F	P	P	F	P	P	F	F	F	P	F	F	F	F	F	G	P	G	F	F	G	G	G
Winter Adults	Viability	Density	F	G	P	F	F	F	G	F	P	F	F	P	F	F	G	F	P	F	P	F	F	F	P	F	F	F
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	F	G	G	G	V	G	G	G	F	F	G	G	G	V	V	G	G	V	G	V	G	V	G	F	F	F
Eggs	Hydrology	Redd Scour	F	V	V	G	P	F	G	F	F	F	G	F	F	F	G	F	F	F	G	G	F	V	F	F	F	G
Eggs	Sediment	Gravel Quality (Bulk)	F	P	F	V	P	P	F	P	F	F	F	F	P	G	F	P	F	P	P	F	F	F	F	F	F	G
Eggs	Sediment	Gravel Quality (Embeddedness)	G	P	P	F	F	F	G	P	P	P	P	F	P	F	F	P	F	F	G	P	F	G	P	F	V	F
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	P	F	F	F	P	F	F	P	P	P	P	P	P	P	P	P	P	F	G	F	G	F	F	G	F
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	F	P	F	P	F	P	P	F	P	P	P	F	F	F	P	P	P	P	P	P	V	P	P	G	G
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	F	P	F	F	P	P	P	P	P	P	P	F	F	F	P	P	P	F	P	P	G	P	P	F	G
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	F	P	F	P	P	F	G	F	F	P	P	P	P	F	P	P	P	P	P	P	F	P	P	P	G	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	P	P	P	P	F	F	P	F	F	V	F	P	F	F	P	P	P	F	P	G	F	V	P	P	G	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	P	P	P	F	P	F	P	P	P	P	P	P	P
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	P	G	G	F	F	P	G	P	F	F	P	P	P	F	P	F	G	G	G	V	G	G	F	F	F	P
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	F	G	G	G	V	F	F	P	F	F	P	F	F	F	F	F	F	G	G	V	G	V	G	F	F	P
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	P	V	G	F	P	P	G	P	V	G	P	F	P	F	G	F	F	V	F	F	V	V	G	F	G	G
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	G	V	G	G	G	P	V	P	F	G	F	F	F	G	F	F	P	G	V	V	G	V	G	F	F	F
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	G	V	G	V	V	V	V	F	P	V	G	V	V	G	F	V	V	V	V	V	G	F	V	V
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	F	F	G	V	V	F	P	F	P	V	F	P	P	P	P	F	F	G	V	F	V	V	P	F	F	F
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	F	F	F	P	P	F	F	P	P	P	F	P	P	P	F	F	P	P	F	G	F	P	F	F
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	V	F	F	G	P	P	P	F	F	P	F	F	P	P	F	G	P	F	F	P	F	V	F
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	P	V	V	V	V	P	P	F	P	F	P	P	F	P	P	F	P	G	V	F	P	F	P	P	F	F
Summer Rearing Juveniles	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	F	F	G	G	F	V	G	G	G	G	G	G	F	G	F
Summer Rearing Juveniles	Water Quality	Turbidity	G	P	P	G	G	P	G	F	F	F	F	F	P	G	G	G	F	G	G	G	G	G	V	G	G	G
Summer Rearing Juveniles	Viability	Density	F	G	P	F	F	F	F	G	P	P	F	P	F	F	F	F	F	G	F	F	F	G	F	F	F	P
Summer Rearing Juveniles	Viability	Spatial Structure	G	V	F	F	G	V	V	V	V	G	F	P	G	V	G	F	P	V	G	V	G	G	G	F	G	G
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	F	P	F	P	F	P	P	F	P	P	P	F	F	F	P	P	P	P	P	P	V	P	P	G	G
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	F	P	F	P	P	P	P	P	P	P	P	F	F	F	P	P	P	F	P	P	G	P	P	F	G
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	P	P	P	P	F	F	P	F	F	V	F	P	F	F	P	P	F	F	F	G	F	V	P	P	G	P
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	F	P	P	F	P	F	P	P	P	P	P	P	P
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	G	V	G	V	V	V	G	G	F	V	G	V	V	G	F	V	V	V	G	V	V	F	V	V
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	F	F	F	P	P	F	F	P	P	P	F	P	P	P	F	F	P	P	F	G	F	P	F	F
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	V	F	F	G	P	P	P	F	F	P	F	F	P	P	F	P	P	F	F	P	F	V	F
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	P	F	G	G	F	F	F	P	G	G	P	F	F	G	G	F	G	G	G	F	F	P	F	F	P	F
Winter Rearing Juveniles	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	G	F	G	G	F	F	V	G	G	G	G	G	F	G	F
Winter Rearing Juveniles	Water Quality	Turbidity	P	P	P	P	P	P	F	P	P	F	F	F	P	F	F	F	F	F	G	P	F	P	F	G	G	F
Smolts	Estuary/Lagoon	Quality & Extent	P	P	F	F	F	P	F	F	P	P	P	P	P	P	P	P	P	P	F	G	F	F	F	F	F	F
Smolts	Habitat Complexity	Shelter Rating	P	P	F	P	F	P	P	P	P	P	P	P	P	F	P	P	P	P	F	P	P	P	P	F	P	P
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	P	V	G	F	P	F	G	F	V	G	F	F	P	F	G	G	G	V	F	G	V	V	G	F	G	G
Smolts	Hydrology	Passage Flows	F	V	V	G	V	F	G	F	F	G	F	G	F	F	P	G	G	V	G	G	G	V	G	F	F	F
Smolts	Passage/Migration	Passage at Mouth or Confluence	G	V	G	G	G	F	V	F	G	G	G	F	F	G	F	G	P	P	G	V	V	V	G	G	F	F
Smolts	Smoltification	Temperature	P	F	V	F	G	P	F	P	F	G	F	F	F	G	P	F	F	V	V	V	G	V	G	F	G	F
Smolts	Water Quality	Toxicity	F	G	G	G	F	F	G	G	G	F	F	G	F	G	G	F	V	V	G	G	G	G	G	F	G	F
Smolts	Water Quality	Turbidity	P	P	P	F	P	F	F	F	F	F	F	F	P	F	F	F	F	F	G	P	F	F	F	F	G	F
Smolts	Viability	Abundance	F	G	P	F	F	G	F	F	F	P	F	P	F	F	F	F	P	F	P	F	F	P	F	F	F	F
Watershed Processes	Hydrology	Impervious Surfaces	V	V	V	V	F	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Watershed Processes	Landscape Patterns	Agriculture	V	V	V	V	V	V	V	V	V	V	F	V	F	G	V	V	V	V	V	V	V	V	V	F	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	V	F	P	G	P	G	G	V	V	V	G	V	P	P	V	V	V	G	F	P	F	V	F	G	G	F
Watershed Processes	Landscape Patterns	Urbanization	V	V	V	V	P	V	V	V	V	V	F	F	V	V	V	V	V	V	V	V	V	V	V	G	V	V
Watershed Processes	Riparian Vegetation	Species Composition	F	F	F	F	G	F	P	F	F	F	F	F	V	G	F	G	F	V	V	G	G	G	F	P	F	G
Watershed Processes	Sediment Transport	Road Density	P	P	P	P	P	P	P	F	G	G	F	G	P	P	F	V	F	P	P	P	P	P	P	P	G	G
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F
Summer Adults	Habitat Complexity	Percent Staging Pools	P	NA	NA	F	NA	F	NA	P	NA	NA	NA	NA	P	NA	P	G	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Habitat Complexity	Shelter Rating	P	NA	NA	P	NA	P	NA	P	NA	NA	NA	NA	P	NA	P	P	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Hydrology	Flow Conditions (Baseflow)	F	NA	NA	F	NA	P	NA	F	NA	NA	NA	NA	P	NA	P	G	G	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Hydrology	Passage Flows	F	NA	NA	G	NA	F	NA	F	NA	NA	NA	NA	P	NA	G	G	G	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Passage/Migration	Passage at Mouth or Confluence	F	NA	NA	G	NA	P	NA	F	NA	NA	NA	NA	F	NA	G	G	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Passage/Migration	Physical Barriers	V	NA	NA	V	NA	V	NA	V	NA	NA	NA	NA	V	NA	F	F	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Sediment	Gravel Quality (Bulk)	F	NA	NA	V	NA	P	NA	P	NA	NA	NA	NA	P	NA	F	P	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Sediment	Gravel Quality (Embeddedness)	G	NA	NA	V	NA	F	NA	P	NA	NA	NA	NA	P	NA	F	P	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Sediment	Quantity & Distribution of Spawning Gravels	P	NA	NA	G	NA	G	NA	P	NA	NA	NA	NA	P	NA	F	G	G	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Velocity Refuge	Floodplain Connectivity	P	NA	NA	G	NA	F	NA	P	NA	NA	NA	NA	F	NA	G	F	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Water Quality	Mainstem Temperature (MWMT)	P	NA	NA	F	NA	P	NA	P	NA	NA	NA	NA	F	NA	P	F	F	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Water Quality	Toxicity	F	NA	NA	G	NA	F	NA	G	NA	NA	NA	NA	F	NA	G	G	V	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Adults	Viability	Abundance	P	NA	NA	F	NA	P	NA	P	NA	NA	NA	NA	F	NA	P	F	P	NA	NA	NA	NA	NA	NA	NA	NA	NA

Life Stages

Based on the viability attribute results, all life stages of NC steelhead were found to be impaired (Table 6 and Figure 15). Winter rearing juveniles were the most impaired life stage across the DPS with 75% of all indicator ratings reported as Poor or Fair (40% as Poor alone), followed closely by the summer adult (72%) and summer rearing juvenile (68%) (Figure 15). Watershed processes, on a DPS level, had a combined 43% of attribute indicators reported as Poor or Fair (Figure 15), of which 31% were rated as Poor.

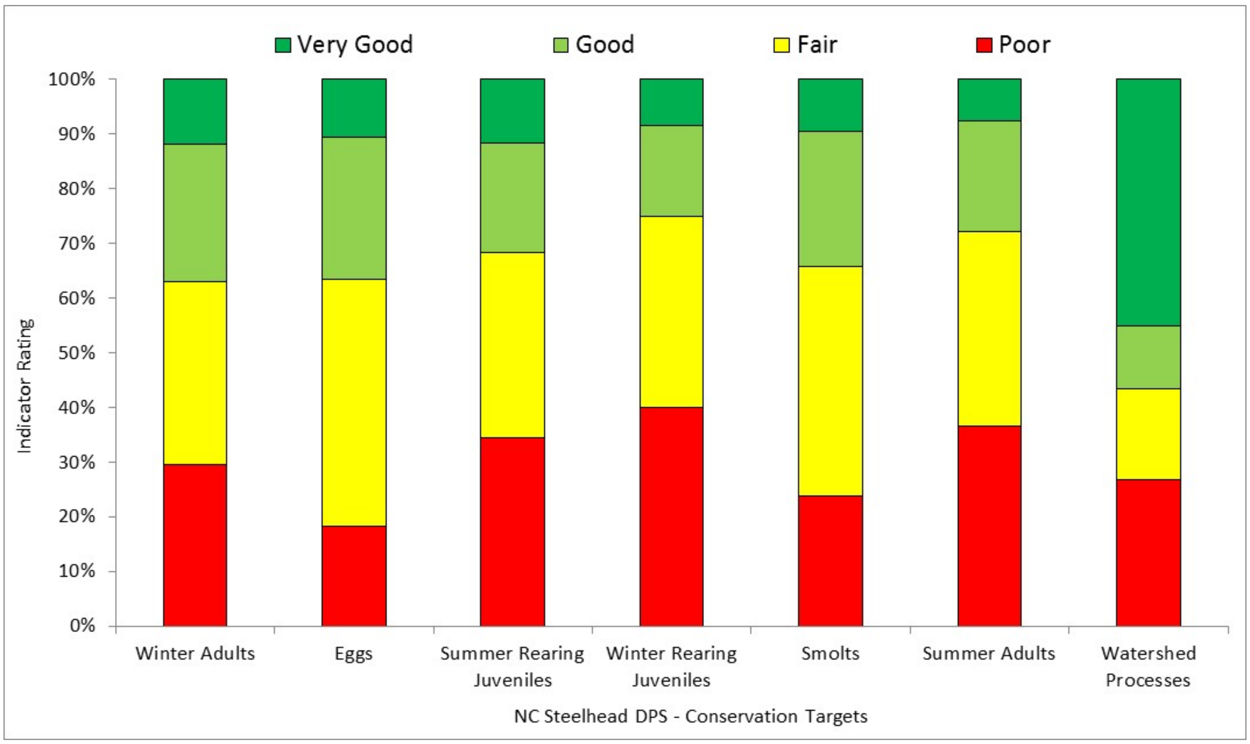

Figure 15: Attribute Indicator ratings for the NC steelhead DPS by life stage.

<u>Winter Adult Attribute Results</u>: Across the DPS, the winter adult life stage had a high percentage (> 60%) of Poor or Fair ratings; exceptions were passage flows, passage at mouth or confluence, physical barriers, the quality and distribution of spawning gravels, and toxicity (Figure 16 and Table 6). The indicators of greatest concern, based on the percentage of Poor ratings alone were large wood frequency, shelter rating, and tree diameter (Table 6). Shelter was rated Poor or Fair in all populations with nearly 80% of populations rated as Poor. Population viability (*i.e.*, low abundance) was also rated as Poor or Fair for winter adults in many populations.

Eggs Attribute Results: Of the four indicators assessed for the egg life stage, the most concerning were those related to gravel quantity (bulk), followed by gravel quality (embeddedness), and the potential for redd scour (Figure 17).

Summer Rearing Juvenile Attribute Results: Attribute indicators most impaired for summer rearing juveniles were estuary/lagoon (quality and extent), habitat complexity (large wood frequency, percent primary pools, pool/riffle/flatwater ratio, and shelter rating), riparian vegetation (tree diameter), sediment (embeddedness), and water temperature (Figure 18 and Table 6). Shelter rating was rated Poor or Fair for all populations within the DPS with 85% of populations rated as Poor. Indicators associated with hydrology (number and magnitude of diversions), passage/migration (passage at mouth or confluence, physical barriers), and water quality (toxicity, turbidity) were rated favorably throughout the DPS with few exceptions (Table 6). Summer rearing juvenile passage was rated Good or Very Good in approximately 70% of the populations within the DPS.

Winter Rearing Juvenile Viability Results: Winter rearing juveniles, the most impaired life stage in the DPS, are largely impacted by poor over-wintering habitat quality (*i.e.,* lack of habitat complexity) (Figure 19). As with summer rearing juveniles, shelter rating was the most impacted attribute indicator with all populations rated as Poor or Fair, of which 81% of populations were rated Poor. Riparian tree diameter was rated Poor or Fair in all but one population in the DPS (Caspar Creek, Table 6). The decline of large diameter trees within the riparian zone has, in part, contributed to the impaired quality of in-stream habitat complexity throughout the DPS. Physical barriers, floodplain connectivity, and stream toxicity indicators were largely rated as Fair or better (Figure 19).

Smolt Attribute Results: As with both winter and summer rearing juveniles, shelter rating was rated Poor (81%) or Fair (19%) for all populations (Figure 20 and Table 6). The quality and extent of estuary/lagoon habitats was also identified as a serious impairment for smolts with nearly all populations (except Ten Mile River) rated as Poor or Fair. Other impaired indicators for the smolt life stage included viability (low abundance) and water quality (turbidity).

Summer Adult Attribute Results: The summer adult life history strategy persists in eight populations within the NC steelhead DPS. These are Redwood Creek, Mad River, Mattole River, South Fork Eel River, Van Duzen River, North Fork Eel River, Middle Fork Eel River, and Upper Eel River Mainstem (Table 6). Across these populations, 73% of all attribute indicator ratings were reported as Poor or Fair (Figure 21) and attribute indicators identified as most impaired for summer adults were shelter rating, viability (low abundance), percent staging pools, gravel quality (bulk), and mainstem water temperature. Reduced floodplain connectivity, low passage flows at a mouth or confluence, poor upstream passage due to physical barriers, and gravel quantity and quality were also rated Poor or Fair for some populations (Table 6).

Watershed Processes: Streamside road density was rated Poor for all but one population in the DPS (Gualala River, Fair) (Figure 22). Roads in general were identified as the most significant impact to current riparian and in-stream habitat quality. Riparian species composition and timber harvest were also rated as moderately impaired with 62% and 38% of populations in the stratum rated Poor or Fair respectively. Relative to more urbanized southern DPS's, the extent of urbanization in the NC steelhead DPS is minimal with only 3 of 26 populations rated as Poor or Fair (Table 6).

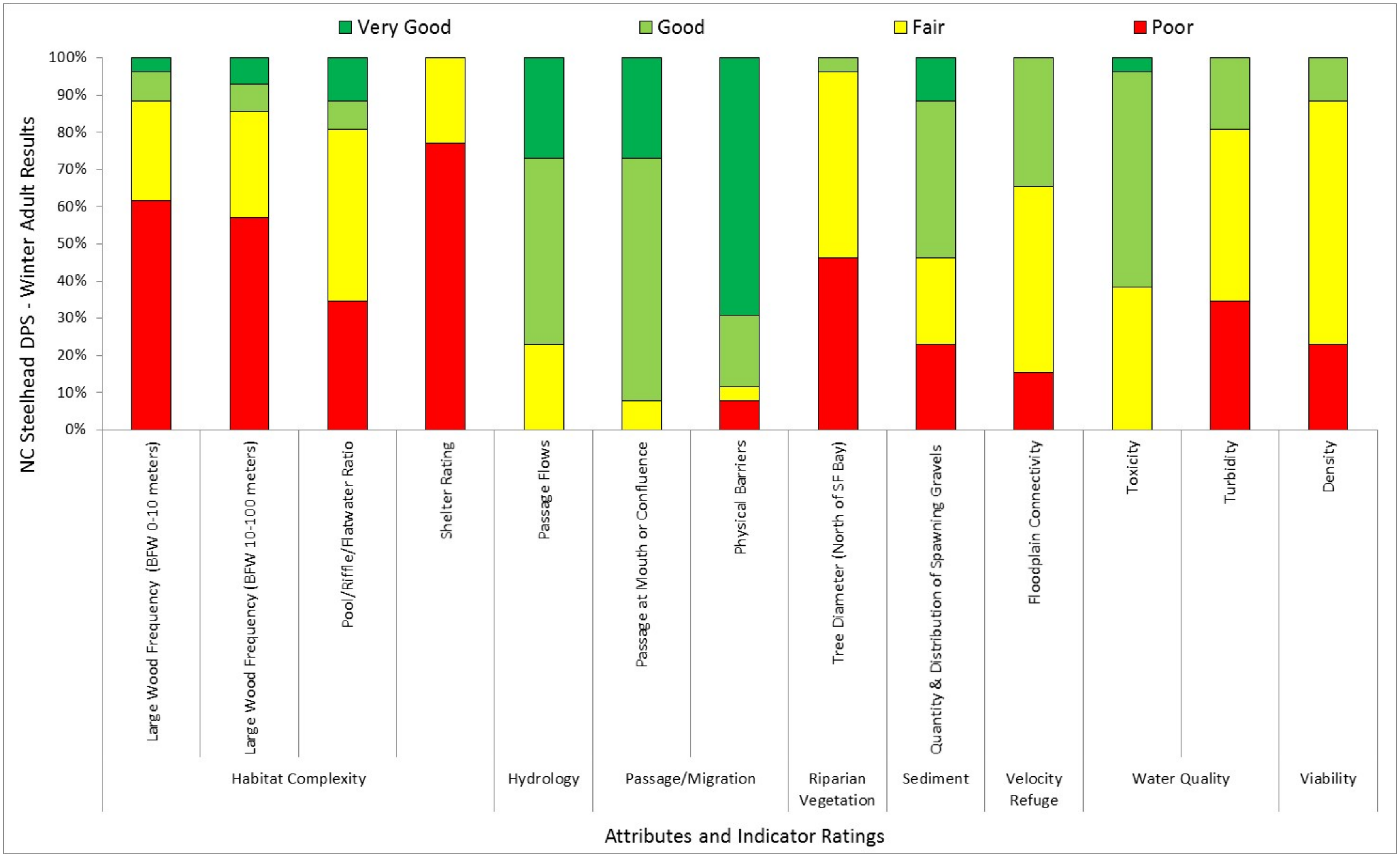

Figure 16: Attribute Indicator ratings for the Winter Adult life stage.

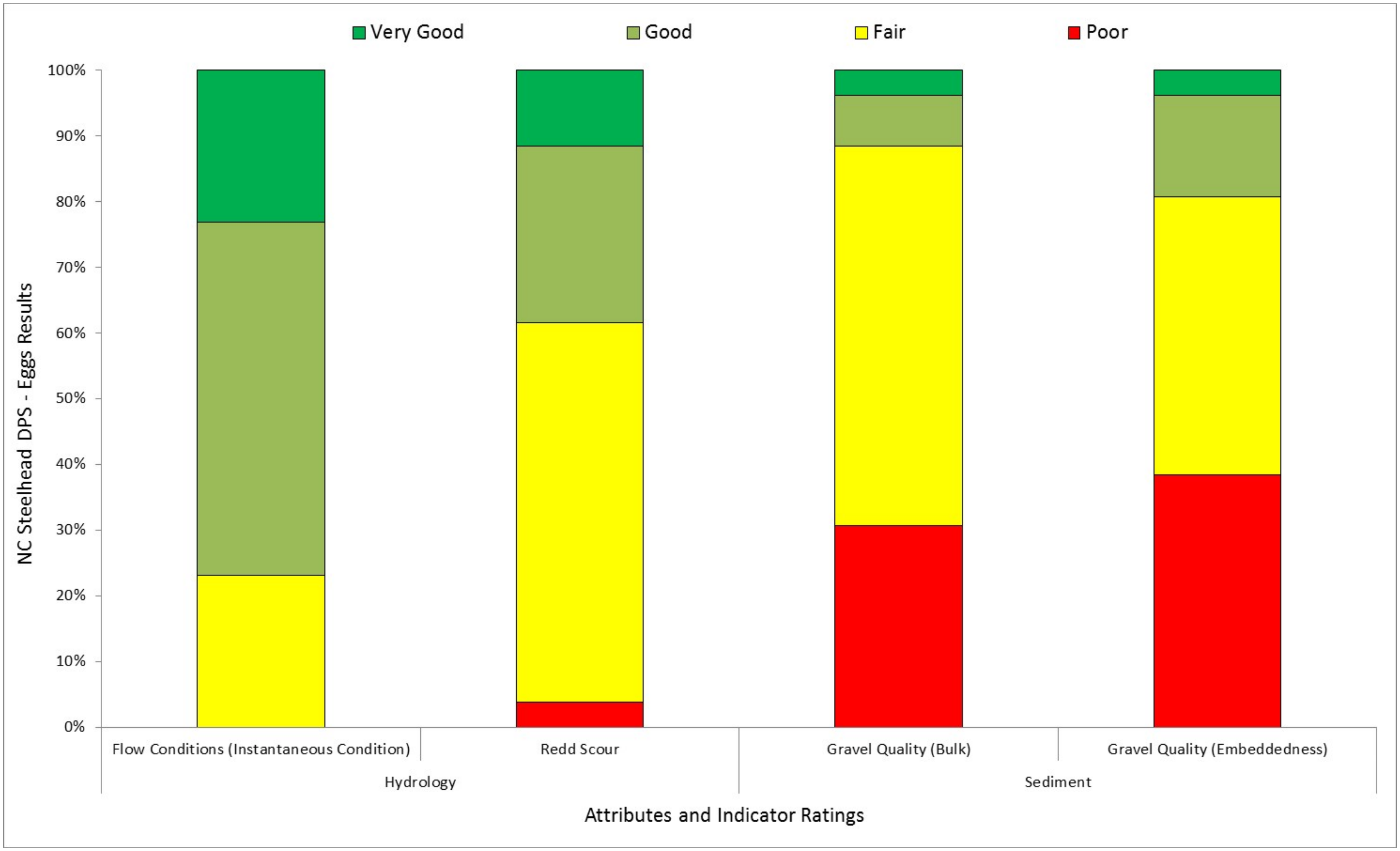

Figure 17: Attribute Indicator ratings for the Egg life stage.

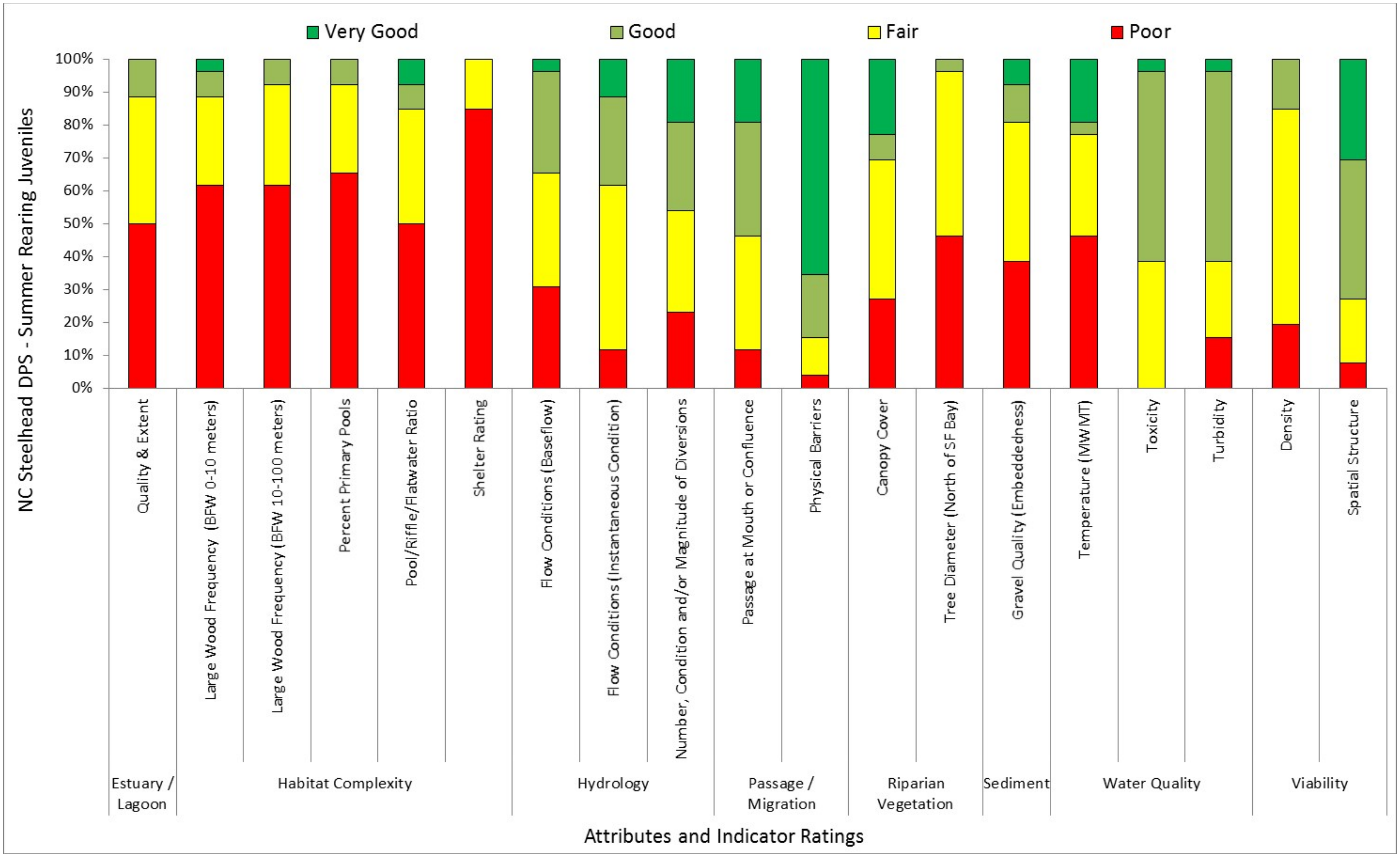

Figure 18: Attribute Indicator ratings for the Summer Rearing Juvenile life stage.

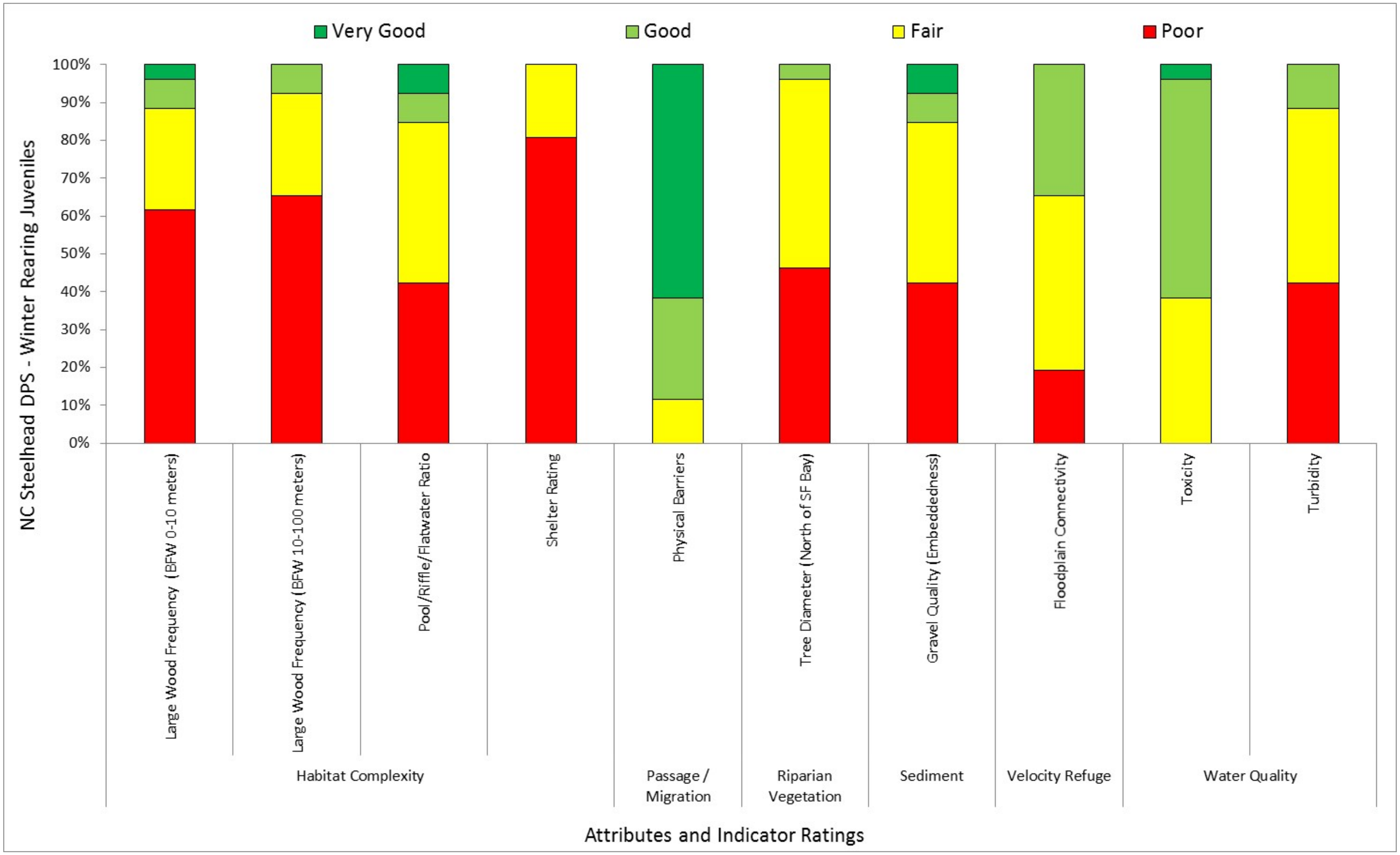

Figure 19: Attribute Indicator ratings for the Winter Rearing Juvenile life stage.

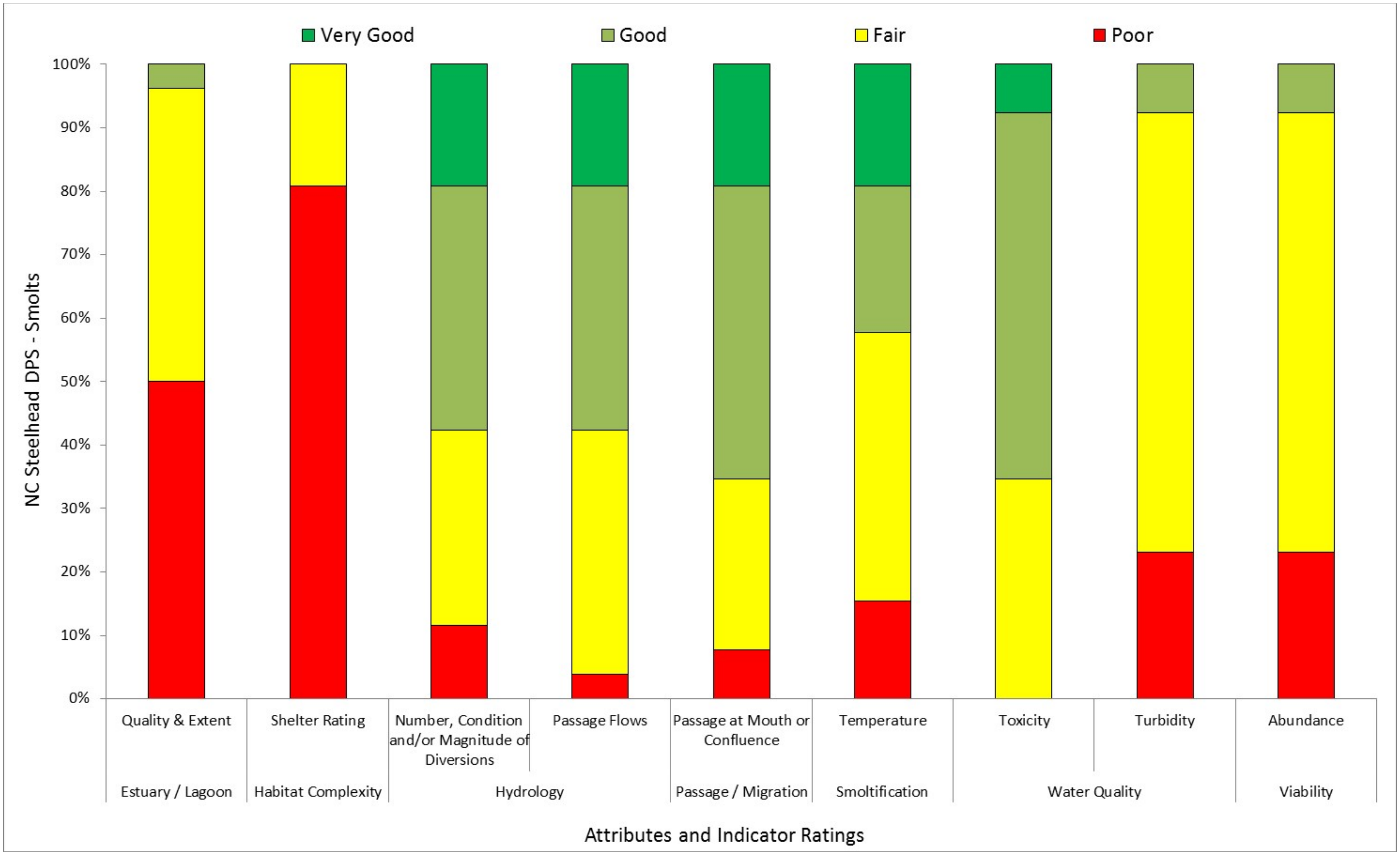

Figure 20: Attribute Indicator ratings for Smolt life stage.

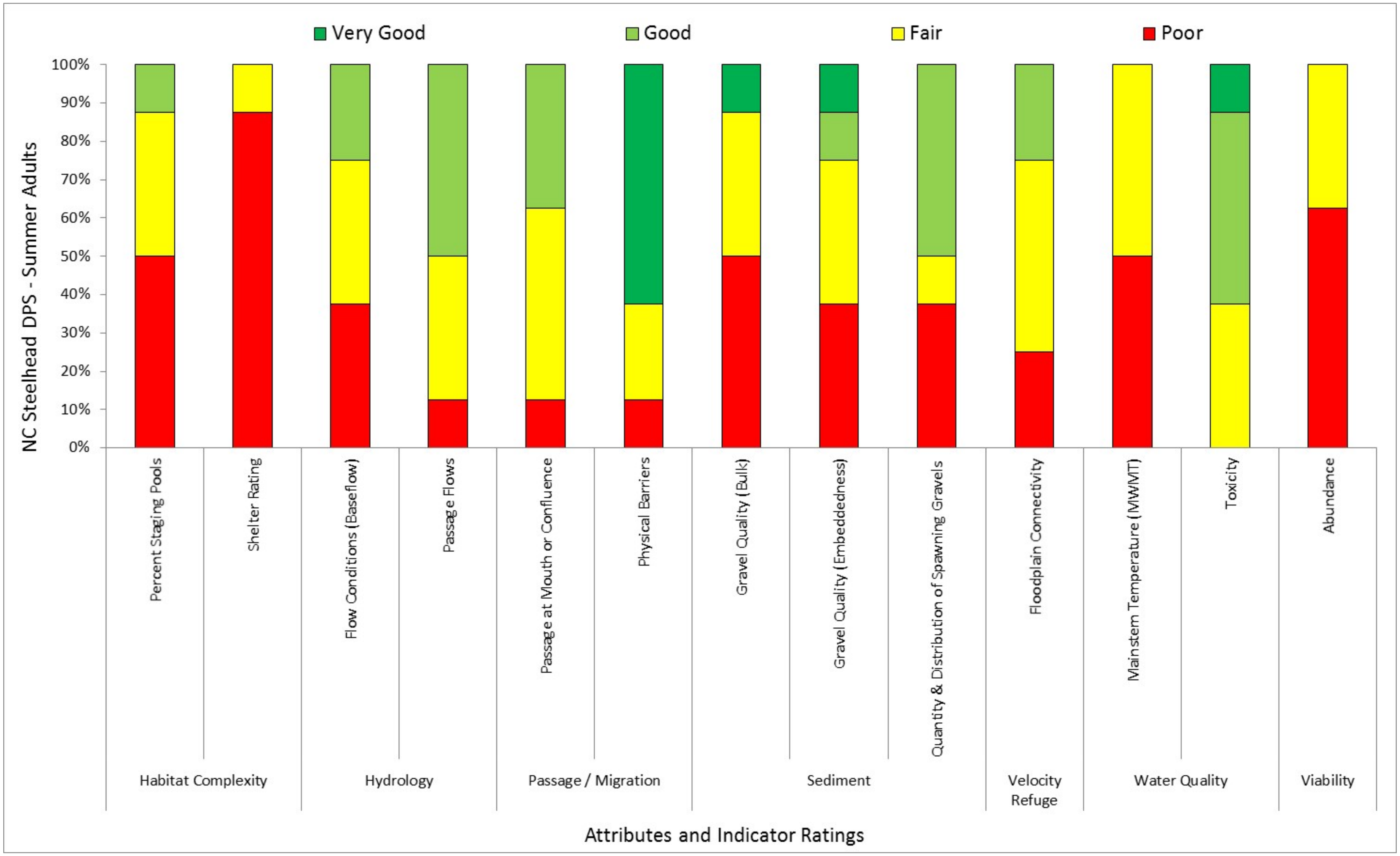

Figure 21: Attribute Indicator ratings for Summer Adult life stage.

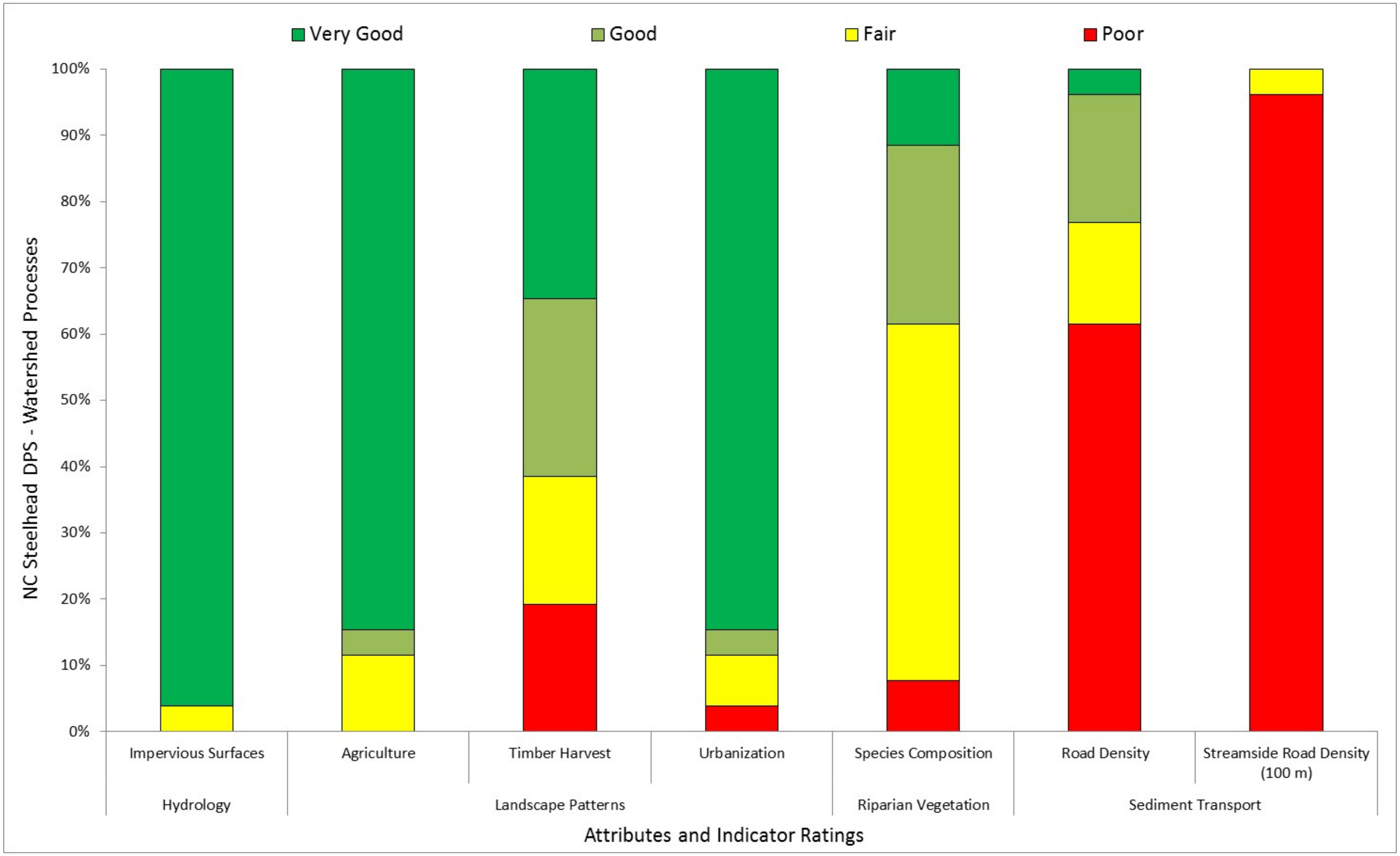

Figure 22: Attribute Indicator ratings for Watershed Processes.

DPS CAP THREAT RESULTS

Table 7 summarizes the CAP threat results across the DPS. Of the 14 identified threats, roads and railroads is the greatest threat with 77% rated Very High or High. This was followed by water diversions and impoundments (38%), logging and wood harvesting (35%), and channel modification (19%) (Table 7 and Figure 23).

Table 7: NC steelhead DPS Threat Summary Table, where L=low, M=medium, H=high, and VH=very high threat. Cells with [-] were not rated or not applicable.

Diversity Strata	Northern Coastal								Lower Interior				North Mountain Interior					North-Central Coastal						Central Coastal		
NC Steelhead Threat/Population	Redwood	Maple Creek/Big Lagoon	Little River	Mad River	Humbold Bay	South Fork Eel River	Bear River	Mattole River	Chamise Creek	Woodman Creek	Outlet Creek	Tomki Creek	Van Duzen River	Larabee Creek	North Fork Eel River	Middle Fork Eel River	Upper Mainstem Eel River	Usal Creek	Wages Creek	Ten Mile River	Noyo River	Caspar Creek	Big River	Navarro River	Garcia River	Gualala River
Agriculture	M	M	M	M	L	M	M	M	M	L	M	L	M	M	M	M	L	-	L	M	-	M	-	M	M	H
Channel Modification	VH	M	M	H	H	H	M	L	M	M	M	-	H	M	M	M	L	L	L	L	L	M	M	L	M	M
Disease, Predation and Competition	H	M	L	L	M	M	M	M	M	M	-	M	H	M	M	M	M	L	L	L	-	M	-	-	L	L
Fire, Fuel Management and Fire Suppression	M	M	L	M	M	M	M	L	L	L	L	L	M	M	M	H	M	M	M	H	L	M	L	L	L	L
Fishing and Collecting	H	M	M	M	M	M	M	M	L	L	L	L	H	M	M	H	M	M	M	M	M	M	M	M	H	M
Hatcheries and Aquaculture	-	-	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Livestock Farming and Ranching	M	M	M	M	H	M	H	M	L	L	M	L	M	M	M	M	L	-	L	L	-	L	-	M	H	M
Logging and Wood Harvesting	H	VH	H	H	M	M	H	H	L	L	M	M	M	M	M	M	L	M	M	H	M	M	M	M	H	H
Mining	H	M	-	H	-	M	M	L	L	L	L	-	M	L	M	L	L	L	L	M	-	-	-	-	L	L
Recreational Areas and Activities	M	M	L	M	L	M	M	L	L	L	-	L	M	L	M	L	L	L	L	L	L	M	L	-	L	L
Residential and Commercial Development	M	M	L	M	M	M	M	M	M	M	M	M	M	L	M	L	L	L	M	L	L	M	-	L	L	L
Roads and Railroads	H	VH	H	H	H	M	VH	VH	H	H	M	M	H	H	H	H	H	H	H	H	M	H	M	M	H	H
Severe Weather Patterns	M	M	M	M	M	H	M	VH	M	M	M	M	M	M	M	M	H	H	M	H	M	M	M	M	M	M
Water Diversion and Impoundments	H	M	M	M	M	H	M	VH	M	M	H	H	H	M	M	M	VH	L	M	M	L	M	L	H	H	H

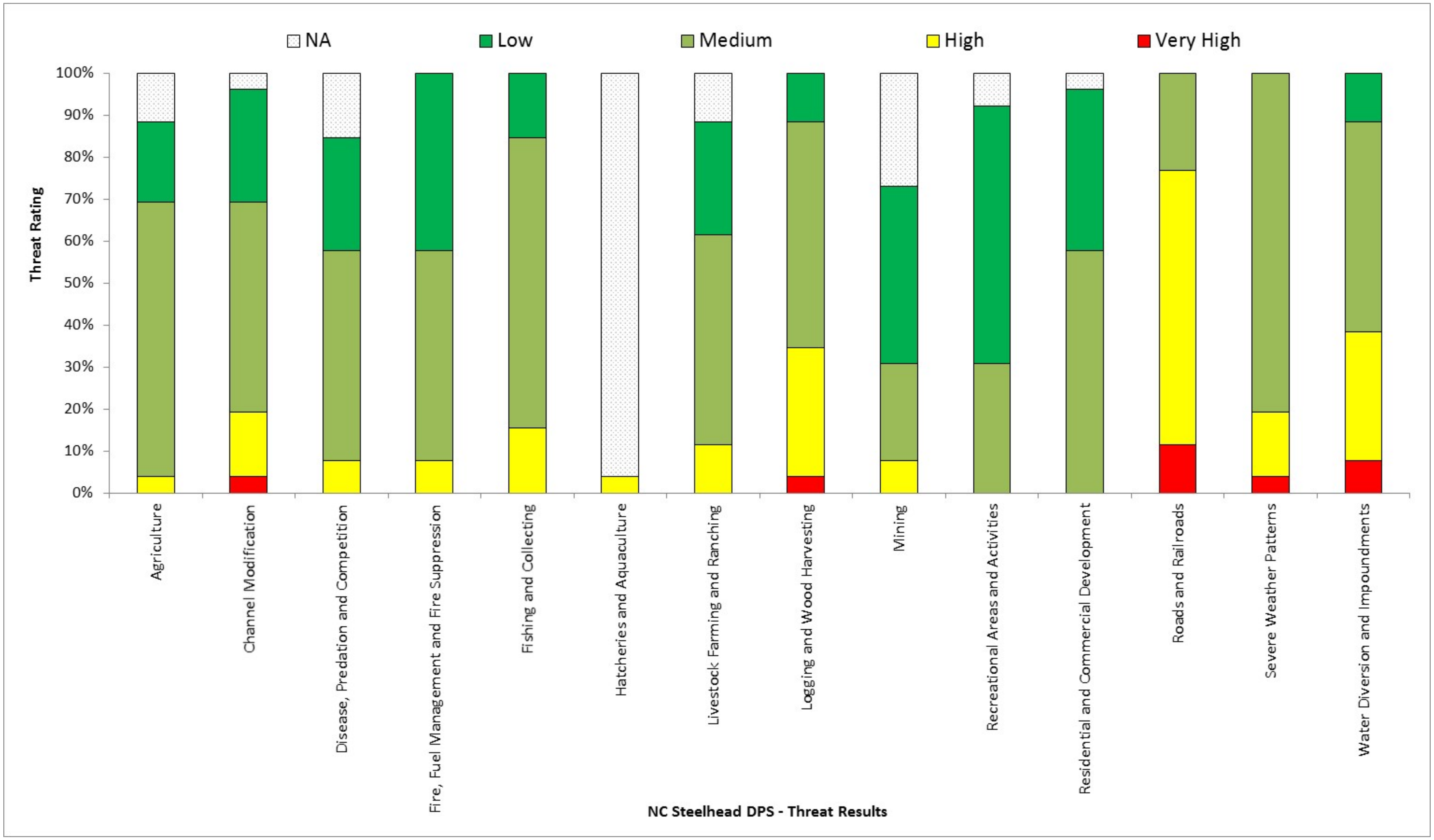

Figure 23: Threat ratings for the NC steelhead DPS

DPS LEVEL RECOVERY ACTIONS

The following recovery actions are DPS-wide recovery actions. DPS-wide recovery actions are recommendations that are designed to address widespread and often multiple threat sources across the range, such as the inadequate implementation and enforcement of local, state, and federal regulations.

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat.				
DPS-NCSW-1.1.1.1	Action Step	Estuary	In estuary/lagoons when applicable, remove problematic infrastructure and fill material to promote the historical seasonal formation and timing of an estuary/lagoon barrier beach	3	20	County, State, NMFS	
DPS-NCSW-1.1.1.2	Action Step	Estuary	Implement patrols by citizens groups, city employees, and law enforcement to ensure seasonal sandbars are not illegally breached.	1	50	City, Citizens, County, CDFW Wardens, NMFS OLE, Non-Profits, Private Landowners,	
DPS-NCSW-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms.**				
DPS-NCSW-1.2.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat.				
DPS-NCSW-1.2.1.1	Action Step	Estuary	Develop and implement Estuary Inflow Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.	2	20	CDFW, NMFS, SWRCB	
DPS-NCSW-1.2.1.2	Action Step	Estuary	Work with local county/city and state organizations to develop alternative methods of flood control to reduce artificial breaching frequency and adverse impacts.	1	10	City, County, NMFS, State	
DPS-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of habitat or range.**				
DPS-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
DPS-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Evaluate opportunities and implement actions for planned retreat of urban development or other incompatible land uses from floodplains, estuaries and alluvial valley streams to recreate natural floodplain processes and complex off-channel habitat and implement such opportunities where appropriate.	1	50	City, County	
DPS-NCSW-2.2	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**				
DPS-NCSW-2.2.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
DPS-NCSW-2.2.1.1	Action Step	Floodplain Connectivity	County zoning should consider the 20-year and 100-year floodprone areas and design protective ordinances and compatible land use designations in these locations.	1	50	County	
DPS-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
DPS-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
DPS-NCSW-3.1.1.1	Action Step	Hydrology	Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	2	50	EPA, City, County, NGO, Private Landowners, State, RWQCB	
DPS-NCSW-3.1.1.2	Action Step	Hydrology	Work with rural residential communities to develop water conservation strategies protective of salmonids while allowing for domestic water use.	2	20	City, County, NGO, Private Landowners, State, SWRCB	
DPS-NCSW-3.1.1.3	Action Step	Hydrology	Work with partners to reduce stormwater run-off by removing impervious surfaces, and creating or expanding flood retention land and groundwater recharge basins.	3	20	City, County, Private Landowners, State, SWRCB	
DPS-NCSW-3.1.1.4	Action Step	Hydrology	Work with the SWRCB to encourage landowners to increase groundwater recharge, permeable surfaces, and percolation through swales and recharge basins in an effort to reduce the flashiness of hydrographs and increase summer baseflow.	1	20	NMFS, Private Landowners, State, RWQCB	
DPS-NCSW-3.1.1.5	Action Step	Hydrology	Work with partners to expand stream flow gaging networks in streams supporting salmonids and/or their habitat.	3	50	CDFW, City, County, NMFS, Private Landowners, State, SWRCB, USGS	
DPS-NCSW-3.1.1.6	Action Step	Hydrology	Meter water diversions for the purposes of measuring instantaneous demand.	2	5	CDFW, City, County, NMFS, Private Landowners, State, SWRCB	
DPS-NCSW-3.1.1.7	Action Step	Hydrology	Use the best scientifically available technology to keep the public informed on stream flows in real time.	3	5	County, NGO, RWQCB, SWRCB	
DPS-NCSW-3.1.1.8	Action Step	Hydrology	Provide financial and technical support and develop partnerships to characterize watershed hydrology and to assess water availability and create water resource budgets.	1	10	CDFW, City, County, NMFS, State, SWRCB	

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-3.1.1.9	Action Step	Hydrology	Effects of consumptive water uses on both the timing and quantity of flow should be minimized. Water-management technologies promoting restoration of natural runoff patterns and water quality should be encouraged.	1	10	CDFW, City, County, NMFS, State, SWRCB	Patterns of water runoff, including surface and subsurface drainage, should match to the greatest extent possible the natural hydrologic pattern for the region in both quantity and quality.
DPS-NCSW-3.1.1.10	Action Step	Hydrology	Evaluate geological patterns in the ESU to identify areas provide sources of cool water and serve as locations to buffer populations against climate change and on-going water diversions.	3	15	County, NMFS, State, USGS	
DPS-NCSW-3.1.1.11	Action Step	Hydrology	Analyze the impacts of well development on stream flow prior to approval.	2	10	County, DWR, NMFS, RWQCB	
DPS-NCSW-3.1.1.12	Action Step	Hydrology	Encourage groundwater recharge through floodplain inundation.	2	15	CDFW, City, County, DWR, NMFS, State, SWRCB	
DPS-NCSW-3.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
DPS-NCSW-3.2.1	Recovery Action	Hydrology	Improve flow conditions				
DPS-NCSW-3.2.1.1	Action Step	Hydrology	Encourage local governments to condition new development to minimize adverse impacts to fisheries resources by integrating hydro-modification concerns into development planning.	2	50	CDFW, City, County, NMFS	For example: new homes should have drought-tolerant landscaping, rainwater catchment systems, and permeable surfaces; new vineyards should demonstrate that their water supply development would minimize adverse impacts to fisheries resources.
DPS-NCSW-3.2.1.2	Action Step	Hydrology	SWRCB in coordination with NMFS, CDFW, and other qualified parties, should develop state-wide minimum summer baseflow requirements protective of salmonids and their habitat.	1	5	CDFW, NMFS, SWRCB	Enforcing the minimum baseflow requirement is necessary to ensure salmonid persistence during drought periods and water right curtailment or when watershed surface flow is over-allocated, and when prosecuting illegal diversions.
DPS-NCSW-3.2.1.3	Action Step	Hydrology	Improve coordination between the agencies, particularly with the SWRCB, to effectively identify and address illegal water diverters and out-of-compliance diverters, seasons of diversion, off-stream reservoirs, and bypass flows fully protective of listed salmonids.	1	5	City, County, CDFW, NMFS, Private Landowners, RWQCB, SWRCB	
DPS-NCSW-3.2.1.4	Action Step	Hydrology	Collaborate with and support the DWR and SWRCB and local agencies to increase oversight for regulating groundwater extraction from aquifers hydrologically connected to surface flows. In addition collaborate to develop groundwater surface water management plans and implement groundwater recharge projects in all alluvial basins.	1	5	City, County, CDFW, DWR, NMFS, Private Landowners, RWQCB	
DPS-NCSW-3.2.1.5	Action Step	Hydrology	NMFS should actively participate in Groundwater Management Plan development (per California's Sustainable Groundwater Management Act) where groundwater pumping is impacting hydrologically connected streamflow.	1	5	City, County, CDFW, DWR, NMFS, RWQCB	
DPS-NCSW-3.2.1.6	Action Step	Hydrology	Encourage local governments to integrate meaningful groundwater regulation for land use planning and to increase coordination with State agencies to ensure applicants secure necessary State permits (e.g., water rights) as part of local permitting processes.	1	5	City, County, CDFW, DWR, NMFS, Private Landowners, RWQCB	
DPS-NCSW-3.2.1.7	Action Step	Hydrology	Extend California Water Code Section 1259.4 dealing with instream flows to protect instream beneficial uses, including native fishes, to central and northern California recovery planning areas with appropriate provisions to address regional differences, including but not limited to construction of off-stream storage as alternative to direct diversions during the dry season.	1	5	SWRCB	
DPS-NCSW-3.2.1.8	Action Step	Hydrology	Water conservation projects should be focused on shifting reliance from on-stream storage to offstream storage, resolve frost protection issues (water withdrawals), and ensure necessary flows for all freshwater lifestages in all water years.	2	10	City, County, CDFW, NMFS, Private Landowners, RWQCB, SWRCB	
DPS-NCSW-3.2.1.9	Action Step	Hydrology	Investigate illegal water diversion and well pumping related to marijuana propagation or other agricultural activities and prosecute violations accordingly	1	10	City, County, CDFW, NMFS, Private Landowners, RWQCB, SWRCB	
DPS-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of habitat or range.**				

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers.				
DPS-NCSW-5.1.1.1	Action Step	Passage	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) need to accommodate 100-year flood flows and associated bedload and debris.	2	50	City, County, NMFS, State	
DPS-NCSW-5.1.1.2	Action Step	Passage	Monitor and update barriers in the Passage Assessment Database (PAD) (https://nrm.dfg.ca.gov/PAD/)	3	50	City, County, NGO, RCD, State	
DPS-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory conditions**				
DPS-NCSW-6.2.1	Recovery Action	Habitat Complexity	Improve habitat complexity				
DPS-NCSW-6.2.1.1	Action Step	Habitat Complexity	Work with Federal and State to develop an application of a programmatic permit for restoration work not funded by FRGP. The objectives of the programmatic should be to reduce costs and fast-track the implementation of high priority recovery actions.	2	5	City, County, CDFW, NGO, NMFS, NOAA RC, Private Landowners, RCD	
DPS-NCSW-6.2.1.2	Action Step	Habitat Complexity	Work with California BOF through implementation of California Forest Protection Rules, Section V, CDFW, RWQCB and others to modify the timber harvest permitting process (including CDFW Lake and Streambed Alteration Agreement process) and provide opportunities and incentives for the implementation of LWD placement and other restoration priorities during timber harvest operations.	3	5	BOF, CDFW, NMFS, RWQCB, Timber Landowners	
DPS-NCSW-6.2.1.3	Action Step	Habitat Complexity	Work with CDFW and the California Fish and Game Commission to remove beavers from California Fish and Game Code Section 4181 that provides any owner or tenant of land or property that is being damaged or destroyed or is in danger of being damaged or destroyed by certain mammals, including beaver, may apply to the department for a permit to kill the mammals.	3	10	CDFW, California Fish and Game Commission, NMFS	
DPS-NCSW-6.2.1.4	Action Step	Habitat Complexity	Work with CDFW and the California Fish and Game Commission to modify Title 14 of the California code of Regulations to prohibit recreational hunting/trapping of beavers within all counties within the NCCC Recovery Domain.	3	10	CDFW, California Fish and Game Commission, NMFS	
DPS-NCSW-6.2.1.5	Action Step	Habitat Complexity	Utilize non-lethal methods where feasible to manage beaver depredation issues (e.g. flooding, crop damage) such as flow devices, fencing, and beaver re-location and enhance habitat complexity.	3	10	CDFW, California Fish and Game Commission, NMFS, Private Landowners	
DPS-NCSW-6.2.1.6	Action Step	Habitat Complexity	Where non-lethal methods prove unfeasible to resolve depredation issues, relocate beaver populations to remote streams where habitat enhancement is needed and resource conflict is low.	3	10	CDFW, California Fish and Game Commission, NMFS, Private Landowners	
DPS-NCSW-6.2.1.7	Action Step	Habitat Complexity	Develop and update a Beaver Management Plan for California to benefit salmonids.	3	10	CDFW, California Fish and Game Commission, NMFS	
DPS-NCSW-6.2.1.8	Action Step	Habitat Complexity	Investigate the current conditon of the high IP reaches in each population and assess the status and develop a restoration plan for those areas.	2	10	City, County, CDFW, NGO, NMFS, NOAA RC, Private Landowners, RCD	
DPS-NCSW-7.1	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory conditions**				
DPS-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
DPS-NCSW-7.1.1.1	Action Step	Riparian	Develop adequately sized riparian setbacks/buffers to protect salmonids habitat where they do not currently occur, and enforce requirements of local regulations where they do.	1	10	County	
DPS-NCSW-7.1.1.2	Action Step	Riparian	Counties should develop a riparian strategy to grow older larger diameter trees for improved canopy and appropriate natural recruitment to the stream. This could be achieved by creating ordinances (where currently non-existent) that limit or prevent the removal of mature trees during infrastructure upgrades or implementation of restoration projects.	3	10	County	
DPS-NCSW-7.1.1.3	Action Step	Riparian	Coordinate with RWQCB to promote policies and planning for adequate riparian area restoration, conservation and protection.	2	10	NMFS, RWQCB, State	
DPS-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
DPS-NCSW-8.1.1.1	Action Step	Sediment	Fund and implement sediment TMDLs within the range of listed salmonids.	2	10	EPA, RWQCB	

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-8.1.1.2	Action Step	Sediment	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	2	10	BOF, CalFire, Caltrans, County, CDFW, NMFS	
DPS-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-10.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants.				
DPS-NCSW-10.1.1.1	Action Step	Water Quality	Work with EPA, RWQCBs and CDFW to identify and prioritize potential contaminants of concern and develop protective standards and programs for issues that directly or indirectly adversely affect the continued existence of listed salmonids.	2	5	EPA, CDFW, RWQCB	
DPS-NCSW-10.1.1.2	Action Step	Water Quality	Conduct outreach to increase awareness of the effects of pharmaceuticals, pesticides and contaminants that impact the continued existence and habitat of listed salmonids.	2	5	EPA, CDFW, NGO, NMFS, RWQCB	
DPS-NCSW-10.1.1.3	Action Step	Water Quality	Support the development and implementation of stormwater BMPs in cities, towns and rural areas.	2	5	City, County, Local, Private Landowners, State, RWQCB	
DPS-NCSW-10.1.1.4	Action Step	Water Quality	Implement performance standards in Stormwater Management Plans.	2	5	City, County, Private Landowners, State, RWQCB	
DPS-NCSW-10.1.1.5	Action Step	Water Quality	Work with pesticide users to educate and advocate for an "integrative pest management framework (IPM)" for pesticide control.	2	5	City, County, NMFS, Private Landowners, State, RWQCB	Best management practices within the IPM include biological control, pesticide choices, removal of pest habitat and resources, barriers, optimal fertilization and irrigation, trap plants, intercropping, and cover crops, and synthetic mulches.
DPS-NCSW-10.1.1.6	Action Step	Water Quality	Work with the California Department of Pesticide Regulation (CDPR) to support changes to professional pesticide application methodologies and timing to limit the potential exposure of watercourses to pesticide runoff.	3	5	City, County, NMFS, Private Landowners, State, RWQCB	For example: change building infrastructure applications of pyrethorids on monthly schedules throughout the entire year including the rainy season to seasons of interest.
DPS-NCSW-10.1.1.7	Action Step	Water Quality	Work with the academic, local, government and non-profit entities (Natural Resource Conservation District, etc.) to support funding of research and use of pesticide alternatives.	3	15	Academic, Local, Government, NGO	These alternatives may include technologies that reduce the amount of pesticides that need to be applied or pest management strategies that require very little pesticide use.
DPS-NCSW-10.1.1.8	Action Step	Water Quality	Work with EPA, RWQCBs, and local stakeholders to implement actions under section 303(d)(1)(C) and (D) of the Clean Water Act requiring States to prepare TMDLs for all water bodies targeted in this recovery plan not currently meeting State of California water quality standards.	2	25	EPA, NMFS, RWQCB, State	
DPS-NCSW-10.1.1.9	Action Step	Water Quality	Install bollards at fire hydrants that are in proximity to streams inorder to prevent hydrants from being hit and discharging chlorinated water into thestreams.	3	10	CalFire, City, County, Local Fire Departments	Hit hydrants will discharge very high volumes of chlorinated water that has thepotential to wipe out a steelhead population in a stream. This action could preventcatastrophic loss of steelhead.
DPS-NCSW-10.1.1.10	Action Step	Water Quality	Research into the potential level of impacts from and solutions to environmental estrogens associated with wastewater discharge and domestic septic leakage are needed.	2	10	Cities, RWQCB, Water Agencies	
DPS-NCSW-10.1.2	Recovery Action	Water Quality	Reduce sedimentation				
DPS-NCSW-10.1.2.1	Action Step	Water Quality	Support actions and tasks identified in the Regional Water Board Staff Work Plan to Control Excess Sediment in Sediment-Impaired Watersheds.	2	10	NMFS, RWQCB	http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/sediment_workplan/
DPS-NCSW-10.2	**Objective**	**Water Quality**	**Address Inadequacy of existing regulatory conditions**				
DPS-NCSW-10.2.1	Recovery Action	Water Quality	Reduce toxicity and pollutants.				
DPS-NCSW-10.2.1.1	Action Step	Water Quality	Work with the RWQCB to support and fast track promulgation of methods to detect impacts from pharmaceuticals, pesticides and other CECs under 40 C.F.R. Part 136, followed by adoption of water quality criteria for pollutants covered by these methods.	2	10	NMFS, RWQCB, State	
DPS-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-11.1.1	Recovery Action	Viability	Increase abundance, spatial structure and diversity				
DPS-NCSW-11.1.1.1	Action Step	Viability	Finalize and implement the California Coastal Salmonid Monitoring Plan.	1	50	CDFW, County, NGO, RCD, Watershed Partners, Water Agencies	Implementing the California Coastal Monitoring Plan is essential for evaluating the long-term viability of listed salmonids in California. For specific components of the Coastal Monitoring Plan see Vol.1 Chapter 6.
DPS-NCSW-11.1.1.2	Action Step	Viability	Prioritize restoration funds, notably the Pacific Coast Salmon Restoration Fund and California's Fisheries Restoration Grant Program (FRGP), to address issues in critical watersheds identified within this recovery plan.	1	50	CDFW, NMFS	
DPS-NCSW-11.1.1.3	Action Step	Viability	Work with the SWFSC to revise the "Intrinsic Potential" model in areas where the model predictions has a severe or high bias and evaluate current conditions where the model indicates the highest values, in order to direct the prioritization of restoration funds.	2	5	NMFS, SWFSC	
DPS-NCSW-11.1.1.4	Action Step	Viability	Support all educational and outreach conferences, events, workshops, etc. that advance the understanding of anadromous salmonid life history, ecology, history, biology, threats, habitat restoration, recovery, and species viability to include all those with a science, restoration, and policy focus.	2	50	Academic, BOF, CalFire, CDFW, NGO, NMFS, SWFSC	
DPS-NCSW-11.1.1.5	Action Step	Viability	Support studies, assessments, science, research, and monitoring (including associated modeling, data management, data analysis, and reporting) that will improve our understanding of species life history and genetic diversity, historical distribution, habitat relationships, status, trends, viability, and spatial structure including those for drought and climate change	2	50	Academic, BOF, CalFire, CDFW, NGO, NMFS, SWFSC	
DPS-NCSW-11.1.1.6	Action Step	Viability	Develop and implement watershed based restoration plans for essential and supporting populations.	1	100	CDFW, Cites, Counties, NGOs, NMFS, RCDs, Water Agencies	Watershed plans should focuses on restoring processes that form, connect, and sustain habitats and provide watershed-wide and reach-specific, detailed restoration actions. Such a plan should be based on geomorphic and ecosystem principles and scientific assessments that: 1) identify the types and natural rates of habitat-forming processes, 2) determine where processes are altered and the factors responsible, 3) decide how to restore the disrupted processes, and 4) provide watershed-wide and reach-specific restoration actions. Once developed, the watershed plans should fit into an adaptive management process and be used to refine actions described in the recovery plan.
DPS-NCSW-11.1.1.7	Action Step	Viability	Federal and State regulatory agencies should encourage city, county and water agencies to incorporate the Multispecies Recovery Plan into their watershed planning documents and Habitat Conservation Plans.	2	100	CDFW, Cites, Counties, NMFS, Water Agencies	
DPS-NCSW-11.2	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DPS-NCSW-11.2.1	Recovery Action	Viability	Monitor habitat quality and extent and watershed land use change				
DPS-NCSW-11.2.1.1	Action Step	Viability	Establish at least one Intensively Monitored Watershed (IMW) within each diversity stratum (preferably a population with a LCM station) to assess the habitat conditions and the effectiveness of implemented restoration actions.	2	50	CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, Water Agencies	IMWs are watersheds that are monitored to the extent that the limiting factors are followed and the impact of management actions on fish or habitat can be demonstrated (see ISEMP at http://www.isemp.org/). Conduct power analysis early in development to determine amount of watershed required to be treated necessary to detect 30-50 percent change in population response. Also, use salmonid response (i.e., presence, abundance, and fitness monitoring) at restoration sites to inform effectiveness over time

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-11.2.1.2	Action Step	Viability	Conduct implementation, effectiveness and validation monitoring for restoration projects where necessary and appropriate.	2	50	CDFW, Cities, Counties, NGO, NOAA SWFSC, NPS, NRCS, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, USFS, Water Agencies	Monitoring must be in accordance with the following specifications: a) The design and implementation of restoration actions should be reported and correlated with known habitat limiting factors, so cumulative impacts can be tracked across the ESU/DPS, b) Where restoration actions are implemented, effectiveness monitoring should be conducted at both the reach and site-specific scales following the Before After Control Impact (BACI) design; and c) Use salmonid response (i.e., presence, abundance, and fitness monitoring) at restoration sites to inform effectiveness over time.
DPS-NCSW-11.2.1.3	Action Step	Viability	Monitor land use and other non-landscape attributes using GIS. In addition to general land use patterns (i.e. agriculture, timber, and urban), other watershed-specific attributes that should be measured include: the extent of impervious surfaces, landslides, watershed road density, and overall riparian conditions. This should be repeated approximately every 10 years.	1	50	CDFW, Counties, NGO, NMFS, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, US EPA, USFS, Water Agencies	
DPS-NCSW-11.2.1.4	Action Step	Viability	Monitor storm-water and agricultural runoff to assess status/trends of turbidity and concentrations of other identified toxins and identify their sources. Where necessary, expand monitoring beyond those already implemented and required by other agencies or laws.	2	50	Cities, Counties, Farm Bureau, NGO, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, State Water Resources Control Board, Trout Unlimited, USEPA, USFS	Where necessary, expand monitoring beyond to other areas or increased frequency than those already required of by other agencies or laws.
DPS-NCSW-11.2.1.5	Action Step	Viability	Monitor water temperature throughout individual populations using arrays of automated data loggers (Isaak et al. 2011), particularly within populations with an LCM station or in populations where water temperature has been identified as a potential limiting factor.	1	50	California Coastal Conservancy, CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, Trout Unlimited, USEPA, USFS, USGS, Water Agencies	
DPS-NCSW-11.2.1.6	Action Step	Viability	Monitor the status and spatial pattern of stream flows, particularly for populations where impaired stream flow was identified as a potential limiting factor.	2	50	CDFW, Cities, Counties, NGO, NOAA SWFSC, NPS, PG&E, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, State Water Resources Control Board, USEPA, USFS, USGS, Water Agencies	Where necessary, coordinate with USGS and/or local governments, non-governmental organizations and water agencies to install additional stream flow gages to assist with stream flow tracking. Seek funding to maintain existing facilities, particularly long-term monitoring gages that may be discontinued due to funding shortages.
DPS-NCSW-11.2.1.7	Action Step	Viability	In accordance with the Coastal Monitoring Plan, develop and implement a water-quality and habitat-condition monitoring program for estuaries and seasonal bar-built lagoons	2	50	CDFW, Counties, NGO, NOAA/NMFS, NPS, Resource Conservation Districts, State Parks	As of Fall 2016, protocols and methods for monitoring water quality and habitat conditions in the estuaries/lagoons have not been developed for the CMP. At a minimum, lagoon water quality monitoring should be conducted for populations where the quality and extent of estuarine/lagoon habitat was identified as a current stress. This should include diurnal, seasonal, and event-based (i.e., a sudden change in weather, inflow, or management actions) monitoring of water temperature, dissolved oxygen, salinity profiles as well as an analysis of seasonal changes in freshwater inflow, depths, and invertebrate abundance and community composition. In addition, monitor the frequency, timing, and associated impacts (see above) of sand bar breaching for all lagoons where authorized and unauthorized manual breaching occurs.

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-11.2.1.8	Action Step	Viability	As part of the Coastal Monitoring Plan, develop and implement a GRTS-based habitat status and trend monitoring program coordinated with the juvenile spatial structure evaluations	1	50	CDFW, Counties, NGO, SWFSC, Resource Conservation Districts, State Parks	The general methods for assessing habitat attributes will follow established programs such as the Columbia River Habitat Monitoring Program (CHaMP)
DPS-NCSW-11.3	**Objective**	**Viability**	**Address the overutilization for commercial, recreational, scientific or educational purposes**				
DPS-NCSW-11.3.1	Recovery Action	Viability	Monitor density, abundance, spatial structure and diversity				
DPS-NCSW-11.3.1.1	Action Step	Viability	In accordance with the Coastal Monitoring Plan, implement an unbiased GRTS-based monitoring program to assess NC steelhead adult spawner abundance estimates at the DPS, diversity stratum, and, population level.	1	50	CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, Trout Unlimited, USACE, USGS, Water Agencies	See the Monitoring and Adaptive Management Chapter in Volume 1 for more information on adult spawner abundance cost estimates.
DPS-NCSW-11.3.1.2	Action Step	Viability	In accordance with the Coastal Monitoring Plan, establish a minimum of one (or preferably two) Life Cycle Monitoring stations within each diversity stratum to estimate spawner : redd ratios, conduct annual smolt abundance/trends, calibrate regional redd counts, and estimate smolt/adult ratios for marine/freshwater survival.	1	50	CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, USACE, USGS, Water Agencies	Strive to have abundance estimates at the LCM stations with a CV on average of 15 percent or less.
DPS-NCSW-11.3.1.3	Action Step	Viability	In accordance with the Coastal Monitoring Plan, implement GRTS-based summer and fall sampling to assess the abundance, distribution and diversity of juvenile NC steelhead.	1	50	CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, Trout Unlimited, USACE, USGS, Water Agencies	Cost estimates are for 50 years of implementation. Annual cost estimate for juvenile spatial distribution, abundance and diversity would cost approximately $2,000 per reach. This estimate assumes a 10% sampling effort of the IP-km.
DPS-NCSW-11.3.1.4	Action Step	Viability	In accordance with the Coastal Monitoring Plan, develop a biological monitoring program for estuaries and seasonal, bar-built lagoons (particularly in LCM populations) that will track salmonid abundance and use of these habitats over time.	1	50	CDFW, Counties, NOAA SWFSC, NPS, Private Consultants, Resource Conservation Districts, State Parks, Trout Unlimited, USACE, USFWS, Water Agencies	These data can be used to document potential limiting factors (e.g., stresses) affecting salmonid rearing in these habitats and highlight emerging threats over time. The estuary/lagoon monitoring protocol for the CMP has not been developed yet.
DPS-NCSW-11.3.1.5	Action Step	Viability	Monitor incidental capture and mortality rates of CC Chinook salmon, NC steelhead, and CCC steelhead in the recreational freshwater fisheries reported from Steelhead Fishing Report-Restoration Cards and creel surveys conducted by CDFW	2	50	CDFW	
DPS-NCSW-11.3.1.6	Action Step	Viability	Continue to annually monitor and assess intentional and incidental capture and mortality rates of CC Chinook salmon, NC steelhead, and CCC steelhead resulting from permitted research to ensure established take limits are adequate to protect these species.	2	50	CDFW, NMFS PRD	
DPS-NCSW-11.3.2	Recovery Action	Viability	Prevent reduced density, abundance, and diversity				
DPS-NCSW-11.3.2.1	Action Step	Viability	Develop Fisheries Monitoring and Evaluation Plans (FMEP) that incorporate delisting criteria, does not limit attainment of population-specific criteria and are specifically designed to monitor and track catch and mortality of wild and hatchery salmon and steelhead stemming from recreational fishing in freshwater and the marine habitats	2	20	CDFW, NMFS	
DPS-NCSW-11.3.2.2	Action Step	Viability	Develop and implement an expanded Genetic Stock Index (GSI) monitoring program for Pacific salmonids. This will help track ocean migrations of Chinook salmon, their origin, and an index of incidental capture and mortality rates in the commercial and recreational fisheries.	3	50	CDFW, NMFS, NOAA SWFSC	
DPS-NCSW-11.3.2.3	Action Step	Viability	Encourage continued scientific research on the effects of Chinook salmon and steelhead population declines on reduced marine-derived nutrients in freshwater habitats (Hill et al. 2010; Moore et al. 2011)	2	50	CDFW, NMFS, NOAA SWFSC	
DPS-NCSW-11.3.2.4	Action Step	Viability	Continue coordination between NMFS and CDFW on revisions to freshwater sport fishing regulations to ensure impacts do no preclude CC Chinook salmon, NC steelhead, and CCC steelhead recovery and impacts to their populations during migrations are minimized	2	50	CDFW, NMFS	
DPS-NCSW-11.4	**Objective**	**Viability**	**Address disease or predation**				
DPS-NCSW-11.4.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				

Northern California Steelhead DPS Level Recovery Actions

Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-11.4.1.1	Action Step	Viability	Annually, estimate the infection and mortality rates of juvenile Chinook salmon and steelhead from pathogens in populations where diseases are identified as a High or Very High threat	3	50	CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, State Parks, USGS, Water Agencies	Infection rates may be determined during spatial sampling throughout the ESU/DPS.
DPS-NCSW-11.4.1.2	Action Step	Viability	Annually monitor the status and trends of non-native predators in populations where predation is identified as a High or Very High threat.	3	50	CDFW, Counties, NGO, NOAA SWFSC, NPS, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, Water Agencies	General status and trends of non-native predators would partially be assessed during the spatially balanced GRTS sampling for juvenile distribution and abundance. Additional monitoring/funding may be necessary for populations with large or fluctuating populations of these species.
DPS-NCSW-11.4.1.3	Action Step	Viability	Coordinate with CDFW to develop and implement plans to assess the impacts of non-native predators on Chinook salmon and steelhead populations, and where necessary, reduce populations of these species	2	50	CDFW, NMFS	
DPS-NCSW-11.4.1.4	Action Step	Viability	During the 5-year status reviews, re-assessing the status of non-native predatory species in populations where predation was not originally identified as a High or Very High threat to ensure expansion of non-native predatory species or the introduction of new predatory species has not occurred	3	50	CDFW, NMFS	
DPS-NCSW-11.4.1.5	Action Step	Viability	Compile information on predation rates of juvenile steelhead and Chinook salmon by birds (freshwater and marine), pinnipeds, and introduced fish species (e.g., striped, largemouth, and smallmouth bass) and encourage additional research and monitoring to further evaluate their impacts and potential strategies for predation reduction	2	50	CDFW, NMFS	
DPS-NCSW-11.4.1.6	Action Step	Viability	Where applicable encourage implementation of Conservation Hatchery programs for severely depressed populations that follow criteria outlined in Spence et al. (2008) an d CDFG (2004)	2	50	CDFW, NMFS, SWFSC	
DPS-NCSW-11.5	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**				
DPS-NCSW-11.5.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
DPS-NCSW-11.5.1.1	Action Step	Viability	Develop a recovery plan tracking system to track the implementation status of specific recovery actions identified in this recovery plan	1	20	NMFS	
DPS-NCSW-11.5.1.2	Action Step	Viability	Monitoring the implementation and effectiveness of Best Management Practices (BMPs)	3	50	BLM, CDFW, Counties, NGO, NMFS, NRCS, Private Consultants, Resource Conservation Districts, State Parks, State Water Resources Control Board, USGS, Water Agencies	With the assistance of other Federal, State, and local resource agencies, track voluntary and required implementation of best management practices (BMPs) within each diversity stratum, compile any post-implementation data that may indicate the effectiveness of the implemented BMPs, and where necessary, conduct effectiveness monitoring of BMPs
DPS-NCSW-11.5.1.3	Action Step	Viability	Develop and implement a randomized sampling program to determine whether permitees are in compliance with permits issued under local and State regulatory actions designed to protect riparian and instream habitat and applicable agencies are enforcing permit requirements.	2	50	CDFW, NMFS, SWRCB, USACE, USEPA, USFWS	
DPS-NCSW-11.5.1.4	Action Step	Viability	Work with CDFW to develop a revised protocol for implementing fish rescue for threatened species under NMFS' ESA section 4(d) rule (50 C.F.R. 223.203(b)(3)) that will enhance rescue response and efficiency, tracking relevant fisheries data obtained during the rescues (e.g., number/densities of fish per area rescued, age classes of rescued fish, and sex ratios of rescued adults), and developing criteria for estimating population-level benefits from the rescues.	1	50	CDFW, NMFS	
DPS-NCSW-11.6	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**				
DPS-NCSW-11.6.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
DPS-NCSW-11.6.1.1	Action Step	Viability	Develop and implement Hatchery and Genetic Management Plans (HGMPs). This will rely on the development of a consistent and timely approval process between CDFW and NMFS	2	20	CDFW, NMFS	

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-11.6.1.2	Action Step	Viability	Conduct annual assessments of the percent of hatchery origin spawners (pHOS) where applicable	1	50	CDFW, NGO, NMFS, NOAA SWFSC, NPS, Pacific States Marine Fisheries Commission, Private Consultants, Private Landowners, Resource Conservation Districts, State Parks, Water Agencies	To achieve broad sense recovery, pHOS should not exceed 10 percent in any population. Estimates of percent hatchery origin would developed using data obtained from spawning ground surveys and from both LCMs and hatcheries.
DPS-NCSW-11.6.1.3	Action Step	Viability	Encourage funding for the continuation and expansion of the SWFSC's ocean net surveys conducted as part of their California Current Salmon Ocean Survey	2	50	CDFW, NMFS, NOAA SWFSC, Pacific States Marine Fisheries Commission	
DPS-NCSW-12.1	**Objective**	**Agriculture**	**Address the present of threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-12.1.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-12.1.1.1	Action Step	Agriculture	Continue existing cooperative conservation programs (such as Fish Friendly Farming or Fish Friendly Ranching, farming organically/biodynamically) in order to minimize the impacts of agricultural operations on habitat quality.	2	20	NMFS, NRCS, Private Landowners, RCD, RWQCB, State	
DPS-NCSW-12.1.1.2	Action Step	Agriculture	Encourage and assist the NRCS and RCDs to increase the number of landowners participating in sediment reduction planning and implementation.	2	20	NMFS, NRCS, Private Landowners, RCD, RWQCB, State	
DPS-NCSW-12.1.1.3	Action Step	Agriculture	Develop incentive programs and incentive-based approaches for landowners who conduct operations in a manner compatible with salmonid recovery requirements.	3	20	NMFS, NRCS, Private Landowners, RCD, RWQCB, State	
DPS-NCSW-12.1.1.4	Action Step	Agriculture	Continue and expand the use of cover crops in agriculture fields to reduce sediment runoff.	3	10	Private Landowners	
DPS-NCSW-12.1.2	Recovery Action	Agriculture	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-12.1.2.1	Action Step	Agriculture	Support projects that build agricultural ponds as an alternative to summer riparian diversions.	2	15	NMFS, NRCS, Private Landowners, RCD, RWQCB, State, SWRCB	
DPS-NCSW-12.1.2.2	Action Step	Agriculture	If water is used for frost protection measures, encourage SWRCB to require the use of flow metering in such circumstances to ensure flows are maintained for other beneficial uses.	2	5	NMFS, Private Landowners, RWQCB, State, SWRCB	
DPS-NCSW-12.1.2.3	Action Step	Agriculture	Utilize BMP's for irrigation (cover crop, drip) and frost protection (wind machines, cold air drains, heaters, or micro-sprayers) which eliminate or minimize water use.	2	10	NMFS, NRCS, Private Landowners, RCD, RWQCB, State	
DPS-NCSW-12.1.2.4	Action Step	Agriculture	Re-design levee systems to back-flood alluvial basin recharge zones in flood tolerant agricultural areas.	3	20	Corps, County, NMFS	
DPS-NCSW-12.2	**Objective**	**Agriculture**	**Address the inadequacies of existing regulatory mechanisms.**				
DPS-NCSW-12.2.1	Recovery Action	Agriculture	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-12.2.1.1	Action Step	Agriculture	NMFS and CDFW should request to be included as technical experts in ongoing legislative efforts to craft marijuana cultivation regulations.	2	5	CDFW, NMFS	
DPS-NCSW-12.2.1.2	Action Step	Agriculture	Counties should condition approval of new developments (e.g. vineyards) in order to require developers to demonstrate that water is available, without adversely affecting public trust resources.	2	10	County, Private, SWRCB	
DPS-NCSW-12.2.1.3	Action Step	Agriculture	Promote the use of reclaimed waste water for agricultural, landscape and other appropriate applications.	2	10	City, County, Private, NMFS, State, RWQCB, SWRCB	
DPS-NCSW-12.2.1.4	Action Step	Agriculture	Encourage the use of low-flow alternatives such as micro-sprinklers, and encourage alternative forms of frost protection that do not use water, such as wind machines.	2	10	City, County, Private Landowners, NMFS, State	
DPS-NCSW-12.2.1.5	Action Step	Agriculture	NMFS and CDFW should work with state/federal attorneys and the Counties District Attorney's office to coordinate prosecutorial strategies for environmental crimes arising from marijuana cultivation.	2	5	CDFW, County, NMFS, State	
DPS-NCSW-12.2.2	Recovery Action	Agriculture	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-12.2.2.1	Action Step	Agriculture	Minimize impacts from new vineyard development by enforcement of land use zoning appropriate to the site to protect floodplain and riparian processes.	2	20	County, CDFW, NMFS	
DPS-NCSW-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-13.1.1	Recovery Action	Channel Modification	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-13.1.1.1	Action Step	Channel Modification	Collaborate with local, state, and federal agencies and non-governmental organizations to acquire fee-title to parcels or conservation easements over strategically-selected stream and riparian corridors to protect salmon and steelhead migratory, spawning, and rearing habitats.	3	50	City, County, Federal, Local, NGO, State	
DPS-NCSW-13.1.1.2	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel. Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.	2	10	City, County, Private Landowner, State, Water Agencies	
DPS-NCSW-13.1.1.3	Action Step	Channel Modification	When bank stabilization projects are required to protect existing infrastructure require bio-engineering methods including use of vegetated soil lifts, log crib walls, willow matresses and planted rock embankments where rip rap is required.	2	10	City, County, Private Landowner, State, Water Agencies	
DPS-NCSW-13.1.1.4	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Focus on ensuring minimal disruption to watershed processes.	2	10	City, County, Private Landowner, State, Water Agencies	
DPS-NCSW-13.2	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms.**				
DPS-NCSW-13.2.1	Recovery Action	Channel Modification	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-13.2.1.1	Action Step	Channel Modification	Encourage Counties and municipalities to adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	15	County, County Municipalities, NMFS	
DPS-NCSW-13.2.1.2	Action Step	Channel Modification	Encourage FEMA to set regulatory standards in its Flood Insurance Program to explicitly address the protection of natural fluvial processes essential for the maintenance of naturally functioning riverine and riparian habitats.	2	15	FEMA, NMFS	
DPS-NCSW-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent or minimize reduced density, abundance, and diversity based on biological viability criteria				
DPS-NCSW-14.1.1.1	Action Step	Disease/Predation/Competition	Provide funding to investigate and remediate impacts of disease and predation to overall viability.	3	20	Academic, CDFW, NMFS, SWFSC	
DPS-NCSW-14.1.1.2	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolt salmonids and implement abatement strategies where appropriate.	2	10	CDFW, NMFS	
DPS-NCSW-14.1.1.3	Action Step	Disease/Predation/Competition	Support CDFW, and other resource agencies to control and contain invasive species in California.	2	10	CDFW, NMFS	
DPS-NCSW-14.1.1.4	Action Step	Disease/Predation/Competition	Provide support to the Invasive Species Council of California (ISCC), and the California Invasive Species Advisory Committee (CISAC) in their efforts to effectively control invasive species.	2	10	CISAC, ISCC, NMFS	
DPS-NCSW-14.1.1.5	Action Step	Disease/Predation/Competition	Work with Counties to modify existing tree ordinances (e.g., Heritage Tree Ordinance) to exclude protection of non-native trees (e.g., *Eucalyptus* sp.) and waive any associated fees for non-native tree removal, particularly when part of a restoration project or on pubic lands.	3	10	County, NMFS, CDFW	
DPS-NCSW-14.1.1.6	Action Step	Disease/Predation/Competition	Promote the practice of Clean, Drain, and Dry for watercraft and equipment used in aquatic environments. Additional information can be found at https://www.wildlife.ca.gov/Conservation/Invasives	2	5	Citizens, CDFW, NMFS	
DPS-NCSW-14.1.1.7	Action Step	Disease/Predation/Competition	Minimize channel modifications that create bare rock walls along migration routes to avoid creating predation habitat for bass. Where feasible modify existing sites that currently act as predation habitat hotspots.	2	19	County, NMFS, CDFW	
DPS-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance.				

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	10	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	2	10	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Include CDFW and NMFS participation on rehabilitation planning teams. During rehabilitation, consider leaving felled trees in streams as LWD source. Re-contour massively modified areas. Storm-proof roads immediately after use. Dispose of suitable organic materials by dispersing them on disturbed soils on the contour. Where larger organic material is available, place in severely burned-out watercourses (assure CDFW/NMFS is a part of this design and decision). Seeding, preferably with local seed-stock, at high hazard/risk areas should be done whenever feasible.	2	10	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Establish fire contingency plans that involve CalFire, local fire districts and regulatory agencies with expertise in fisheries issues.	2	10	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.1.5	Action Step	Fire/Fuel Management	Use controlled, low severity fire to dampen fuel loading and crowding of forest vegetation.	2	10	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
DPS-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	Disseminate recommendations from NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	5	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.2.2	Action Step	Fire/Fuel Management	Locate chemicals, petroleum products, latrines, camp sites, etc., out of riparian buffer and place on flat ground.	2	5	CalFire, CDFW, Local Fire Districts, NMFS	
DPS-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Obtain water from lakes and reservoirs not occupied by listed salmonids when possible. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	2	100	CalFire, CDFW, Local Fire Districts, NMFS	NMFS anticipates that it will take up to 5 years for this to be implemented but should continue in perpetuity
DPS-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes.**				
DPS-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on biological viability criteria				
DPS-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Fishery managers should work with NMFS to develop Fishery Management and Evaluation Plans to prevent extinction and ensure fishery management is consistent with recovery of the species, and cover incidental take of federally listed salmonids.	1	5	CDFW, CA Fish and Game Commission, NMFS SFD, SWFSC	
DPS-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Collaborate with CDFW to develop appropriate fisheries data in select indicator watersheds that will support Fishery Management and Evaluation Plans (FMEPs).	1	5	CDFW, CA Fish and Game Commission, NMFS	
DPS-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFW and Fish and Game Commission to refine freshwater sport fishing regulations to minimize unintentional and unauthorized take, and incidental mortality, of listed species by anglers during the migration period. This effort could include development of specific emergency regulations during adult migration periods between September and January, low-flow closures (much like Washington State) and angler outreach programs.	1	5	CDFW, CA Fish and Game Commission, NMFS	
DPS-NCSW-16.1.1.4	Action Step	Fishing/Collecting	Work with CDFW to develop protective regulations and seek funds for additional Game Wardens to minimize impacts from fishing during the migratory period (e.g., until sandbars open naturally) within one mile of the river mouths of watersheds with essential or supporting populations.	1	5	CDFW, CA Fish and Game Commission, NMFS	
DPS-NCSW-16.1.1.5	Action Step	Fishing/Collecting	Improve CDFW's Freshwater Sport Fishing Regulations by considering prohibiting removal of wild salmonids from the water in catch-and-release fisheries.	2	5	CDFW, CA Fish and Game Commission, NMFS	

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-16.1.1.6	Action Step	Fishing/Collecting	Utilizing the "reminder postcard" in efforts to increase Steelhead Report Card (SRC) return rates has worked well and is applauded by fisheries managers. Work with CDFW to consider providing, additional incentives to return SRCs by the January 31 deadline to save time and money while gaining more angler participation, which will provide more accurate information for agency evaluation.	2	5	CDFW, CA Fish and Game Commission, NMFS	
DPS-NCSW-16.1.1.7	Action Step	Fishing/Collecting	Work with CDFW to bring more awareness to special salmonid conservation propagation programs and improve salmonid identification outreach; especially in areas where a mixed stock fishery occurs (example: Russian River).	2	5	CDFW, CA Fish and Game Commission, NMFS	
DPS-NCSW-16.1.1.8	Action Step	Fishing/Collecting	Consider banning felt sole wading boots in California waters in efforts to minimize or eliminate the spread of aquatic diseases and invasive species (example: didymo, New Zealand mud snails, whirling disease, etc.).	2	5	CDFW, CA Fish and Game Commission, NMFS	
DPS-NCSW-16.1.1.9	Action Step	Fishing/Collecting	Consider other incentives for greater angler participation in fisheries restoration efforts.	2	10	CDFW, CA Fish and Game Commission, NMFS	For example, the Game Warden Stamp is an excellent way to gain more angler and hunter participation and support. Other stamp, sponsorships, and/or lottery fundraising programs that support recovery objectives should be discussed and developed.
DPS-NCSW-16.1.1.10	Action Step	Fishing/Collecting	Collaborate with NOAA OLE, CDFW, Tribes and stakeholders groups to enhance anti-poaching efforts in essential and supporting populations.	2	5	CDFW, Local Citizens, NOAA OLE, Tribes	
DPS-NCSW-17.1	**Objective**	**Hatcheries**	**Address other natural or manmade factors affecting the species' continued existence.**				
DPS-NCSW-17.1.1	Recovery Action	Hatcheries	Prevent or minimize reduced density, abundance, and diversity based on biological viability criteria				
DPS-NCSW-17.1.1.1	Action Step	Hatcheries	For all hatchery operations, develop and implement HGMPs consistent with 50 CFR 223.203(b)(5) and hatchery criteria identified in Spence et al. (2008).	1	10	CDFW, Hatchery Managers, NMFS	Ensure the threat of hatcheries remains low for listed salmonids for current, and all future, hatchery programs.
DPS-NCSW-17.1.1.2	Action Step	Hatcheries	Hatchery managers need to implement the recommendations in the California Hatchery Scientific Review Group report (California HSRG 2012), where appropriate.	2	10	CDFW, Hatchery Managers, NMFS	
DPS-NCSW-17.1.1.3	Action Step	Hatcheries	Where applicable, for severely depressed populations investigate the implementation of Conservation Hatchery programs that follow criteria outlined in Spence et al. (2008) and CDFG (2004).	2	20	CDFW, Hatchery Managers, NMFS, SWFSC	
DPS-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**				
DPS-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-18.1.1.1	Action Step	Livestock	Aid and encourage willing landowners to fence livestock from the stream channel, municipal water sources and riparian zones and develop offstream alternative water sources.	2	15	NRCS, RCD, Private Landowners	
DPS-NCSW-18.1.1.2	Action Step	Livestock	Encourage Livestock and Ranch Managers to utilize Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California (MRCD, 2007), and Management Tips to Enhance Land & Water Quality for Small Acreage Properties (Sotoyome RCD, 2007), and The Grazing Handbook (Sotoyome RCD, 2007).	3	15	NRCS, RCD, Private Landowners	
DPS-NCSW-18.1.1.3	Action Step	Livestock	Establish conservative residual dry matter (RDM) targets per acre to ensure areas are not overgrazed at the end of grazing season. Remove cattle from pasture before soils dry out.	3	15	NRCS, RCD, Private Landowners	
DPS-NCSW-18.1.1.4	Action Step	Livestock	Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff, improve soil conditions, minimize noxious weeds, and encourage native revegetation.	3	15	NRCS, RCD, Private Landowners	
DPS-NCSW-18.1.1.5	Action Step	Livestock	Work with existing cooperative conservation programs (such as Fish Friendly Farming or Fish Friendly Ranching) in order to minimize the impacts of Livestock operations on habitat quality.	3	15	NRCS, NMFS, RCD, Private Landowners	
DPS-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
DPS-NCSW-18.1.2.1	Action Step	Livestock	Implement practices as outlined in the University of California guidelines for water quality protection (Ristow 2006).	2	10	NRCS, RCD, Private Landowners	

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-18.1.2.2	Action Step	Livestock	Implement recommendations of the California Rangeland Water Quality Management Program.	2	10	NRCS, RCD, Private Landowners	
DPS-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of habitat or range.**				
DPS-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-19.1.1.1	Action Step	Logging	Encourage development of a GCP/HCP/Natural Community Conservation Plan (NCCP), conservation easements, conservation banks, or safe harbor agreements with industrial or non-industrial forestland owners.	2	50	County, Private Landowners, NMFS, State, Timber Landowners	
DPS-NCSW-19.1.1.2	Action Step	Logging	Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through ESA Section 10(a)(1)(B).	3	15	NMFS, Private Landowners, Timber Landowners	
DPS-NCSW-19.1.1.3	Action Step	Logging	Consider assigning NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004) and work to implement recommendations as a result of these reviews	3	5	NMFS	
DPS-NCSW-19.1.1.4	Action Step	Logging	The State should consider a Salmonid Watershed Database (similar to the CDFW Northern Spotted Owl database) for RPFs to acquire standardized information on populations and habitat conditions in the watersheds associated with their harvest plan.	3	15	BOF, CDFW, Timber Landowners	
DPS-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**				
DPS-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-19.2.1.1	Action Step	Logging	Discourage Counties from rezoning forestlands or identified TPZ areas to rural residential or other land uses (e.g., vineyards).	3	50	County, NMFS	
DPS-NCSW-19.2.1.2	Action Step	Logging	Increase THP inspections by CalFire especially during winter months.	3	50	BOF, CalFire, CDFW, NMFS, Private Landowners, Timber Landowners	
DPS-NCSW-19.2.1.3	Action Step	Logging	Encourage to CalFire and BOF to explore a statewide Forestry HCP (similar to that developed in Washington State), GCP, safe harbor agreements, and seek funding opportunities to support the effort.	2	20	BOF, CalFire, CDFW, NMFS, Private Landowners, Timber Landowners	
DPS-NCSW-19.2.1.4	Action Step	Logging	Work with the BOF through implementation of California Forest Practice Rules, Section V, CalFire, CDFW, professional organizations and landowners to modify the timber harvest permitting process to provide opportunities and incentives for LWD recruitment during timber harvest operations.	1	25	BOF, CalFire, CDFW, NMFS, Private Landowners, Timber Landowners	
DPS-NCSW-19.2.1.5	Action Step	Logging	California BOF should consider requiring (1) EIRs for all forestland conversions, (2) adopting a forestland Conversion THP, (3) elimination of the subdivision exemption, (4) raising forestland conversion permit fees, (5) developing requirements to offset loss of timberland, (6) incentivize restoration of unproductive timberlands, (7) investigate conservation banking programs and (8) coordinate with the other agencies involved for more CalFire oversight on forestland conversions.	1	10	BOF, CDFW, NMFS, Private Landowners, Timber Landowners	
DPS-NCSW-20.1	**Objective**	**Mining**	**Address the present or threatened destruction, modification, or curtailment of habitat or range.**				
DPS-NCSW-20.1.1	Recovery Action	Mining	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-20.1.1.1	Action Step	Mining	In sites with legacy terrace gravel mining pits, remove, setback, or breach levees and re-contour mining pits to an elevation inundated by frequent winter river/stream flows; Restore the inset floodplain at elevation appropriate for modern channel and regulated winter/spring base flows.	2	20	County, EPA, NMFS, Private, State	
DPS-NCSW-20.1.1.2	Action Step	Mining	Where economically and geomorphically feasible use gravel mining to create seasonal off-channel wetland, pond, alcove and secondary channel floodplain habuitats to increase winter refuge and rearing habitat.	2	10	County, EPA, NMFS, Private, State	
DPS-NCSW-20.2	**Objective**	**Mining**	**Address the inadequacy of existing regulations**				
DPS-NCSW-20.2.1	Recovery Action	Mining	Prevent or minimize increased landscape disturbance.				

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-20.2.1.1	Action Step	Mining	NMFS National Gravel Extraction Guidance (2005, 2014) and NMFS Southwest Region (2004) should be followed for all existing and proposed projects.	2	20	County, EPA, NMFS, Private, State	
DPS-NCSW-20.2.1.2	Action Step	Mining	Given the need for enormous amounts of water during fracking, oil companies and state/federal regulators should consult with NMFS/CDFW to ensure adequate water resources exist prior to developing the well. Avoid fracking operations that obtain water from underground aquifers hydrologically connected with surface streamflow.	2	10	County, EPA, NMFS, Private, State	
DPS-NCSW-20.2.1.3	Action Step	Mining	Evaluate the potential for fracking to impact surface water quality (and thus impact salmon and steelhead) where hydrologic connectivity between ground and surface water exists.	2	10	EPA, NMFS, RWQCB, State	
DPS-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**				
DPS-NCSW-21.1.1	**Objective**	**Recreation**	**Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)**				
DPS-NCSW-21.1.1.1	**Objective**	**Recreation**	**Manage or limit mountain bike and equestrian activity on trails within state parks, state forests and on other publically-owned land that cause soil compaction, increased surface erosion, increased storm runoff and increased sediment input to stream channels**	3	10	City, County, Public, State	
DPS-NCSW-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**				
DPS-NCSW-22.1.1	Recovery Action	Residential/Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
DPS-NCSW-22.1.1.1	Action Step	Residential/Commercial Development	Design new developments to avoid or minimize impact to unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to the habitat of listed salmonids.	3	20	City, County, County Planners, Public Works, State	
DPS-NCSW-22.1.2	Recovery Action	Residential/Commercial Development	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-22.1.2.1	Action Step	Residential/Commercial Development	Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining a mature and properly functioning riparian zone.	3	5	City, County, County Planners, Public Works, State	
DPS-NCSW-22.1.2.2	Action Step	Residential/Commercial Development	New development in all watersheds with essential and supporting populations should be designed to minimize storm-water runoff and changes in duration or magnitude of peak flow.	3	20	City, County, County Planners, RWQCB, State	
DPS-NCSW-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms.**				
DPS-NCSW-22.2.1	Recovery Action	Residential/Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow).				
DPS-NCSW-22.2.1.1	Action Step	Residential/Commercial Development	As mitigation for potential adverse consequences to a watershed's hydrograph, municipalities and counties should develop and implement larger or more effective stormwater detention methods in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	2	20	CDFW, County, Municipalities, NMFS, SWRCB	
DPS-NCSW-22.2.1.2	Action Step	Residential/Commercial Development	Develop and implement regulations for activities that intercept groundwater recharge.	2	10	CDFW, County, DWR, NMFS, SRWCB	
DPS-NCSW-22.2.1.3	Action Step	Residential/Commercial Development	Work with partners to develop legislation that will fund county planning for environmentally sound growth and water supply development and work in coordination with California Dept. of Housing, and other government associations (CDFG 2004).	2	30	County, NMFS, State	
DPS-NCSW-22.2.2	Recovery Action	Residential/Commercial Development	Prevent or minimize increased landscape disturbance.				
DPS-NCSW-22.2.2.1	Action Step	Residential/Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	50	City, County, County Planner	

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-22.2.2.2	Action Step	Residential/Commercial Development	Modify Federal, State, city and county regulatory and planning processes to prevent or minimize new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all watersheds with essential and supporting populations.	2	15	City, County, Federal, NMFS, State	
DPS-NCSW-22.2.2.3	Action Step	Residential/Commercial Development	Identify forestlands or oak woodland areas at high risk of conversion, and develop incentives and alternatives for landowners to discourage conversion.	3	15	City, County, County Planner	
DPS-NCSW-22.2.2.4	Action Step	Residential/Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential development.	2	50	City, County, County Planner, NMFS, State	
DPS-NCSW-22.2.2.5	Action Step	Residential/Commercial Development	Develop legislation that will fund county planning for environmentally sound growth and water supply and work in coordination with California Dept. of Housing, Association of Bay Area Governments, and other government associations (CDFG 2004).	2	15	City, County, County Planner, NMFS, State	
DPS-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
DPS-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
DPS-NCSW-23.1.1.1	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply, at a minimum, the road standards outlined in the most recent version of the California Forest Practice Rules.	2	50	BOF, Local, RWQCB, Timber Landowners	For roads subject to the California Forest Practices Rules
DPS-NCSW-23.1.1.2	Action Step	Roads/Railroads	Design new roadways to avoid or minimize effects to unstable slopes, wetland, floodplains and other areas of high habitat value.	2	50	BOF, Local, RWQCB, Timber Landowners	This action is consistent with requirements in California Forest Practices Rules at 14 CCR §§ 923 - 923.9.1.
DPS-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	50	BOF, Local, RWQCB, Timber Landowners	This action is consistent with requirements in California Forest Practices Rules at 14 CCR §§ 923 - 923.9.1.
DPS-NCSW-23.1.1.4	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads adjacent to streams supporting listed salmonids should be considered an extremely high priority for funding (e.g., PCSRF).	2	50	BOF, Local, RWQCB, Timber Landowners	
DPS-NCSW-23.1.1.5	Action Step	Roads/Railroads	Conduct outreach and continual education regarding the adverse effects of roads and the types of best management practices protective of salmonids. Education should address watershed process and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	50	BOF, CalTrans, CDFW, NMFS, Timber Landowners	
DPS-NCSW-23.1.1.6	Action Step	Roads/Railroads	Evaluate and mitigate (where appropriate) the effects of transportation corridors and infrastructure on estuarine and stream fluvial processes. Mitigating measures may include, elevating existing approach, fill and maximizing clear spanning of upstream active channel(s), floodways, and floodplains to accommodate natural riverine and estuarine fluvial processes.	3	50	CDFW, NMFS, Timber Landowners	
DPS-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration.				
DPS-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and review appropriate barrier databases when developing new or retrofitting existing road crossings.	2	50	CalTrans, CDFW, City, County, County Planner, Engineers, NMFS, State	
DPS-NCSW-23.1.2.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents (i.e., pilings) feasible in order to minimize drift accumulation and facilitate fish passage.	2	50	CalTrans, CDFW, City, County, County Planner, Engineers, NMFS, State	
DPS-NCSW-23.1.2.3	Action Step	Roads/Railroads	For impact pile driving during construction, develop and implement sound attenuation methods that ensure sound levels are (1) below thresholds for onset of physical injury to fish (see NMFS' 2008 Interim Criteria for Injury to Fish from Pile Driving), (2) avoiding adverse behavioral effects (e.g., during adult migration, etc.), and (3) minimized by a reduction in the sound field (e.g., reduce the size of the area impacted). In situations where sound attenuation is not able to keep sound pressure at sub-injurious levels (i.e., sound levels that will not harm or injure fish), work should be conducted during seasonal work windows to avoid migrating salmonids.	2	50	CalTrans, CDFW, City, County, Engineers, NMFS, State	
DPS-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance.				

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-23.1.3.1	Action Step	Roads/Railroads	Encourage implementation of Vegetation Management Plans for the roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	50	CalTrans, CDFW, City, County, NMFS, State	
DPS-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms.**				
DPS-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-23.2.1.1	Action Step	Roads/Railroads	Support and engage CalTrans, counties and others with oversight on road practices to reduce sediment delivery to streams from road networks and channelization from poorly situated roads.	2	50	CalTrans, County, NMFS, RWQCB	
DPS-NCSW-23.2.1.2	Action Step	Roads/Railroads	Encourage enforcement of existing regulations regarding grading, riparian and building violations and sediment release from county roads.	2	50	CalTrans, County, NMFS, RWQCB	
DPS-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence.**				
DPS-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Actively conduct outreach to stakeholders and the public regarding anticipated effects of climate change to salmonids and increase awareness that human actions can offset these effects. The public, local, state and federal agencies should become familiar with, and implement as necessary through lifestyle and policy changes, recommendations of the Intergovernmental Panel on Climate Change (IPCC).	3	5	Federal, Local, NMFS, Public, State	See the website http://www.ipcc.ch to view a summary of climate change issues for North America and the suite of actions from the IPCC to be considered for ecosystem (and human health) due to climate change.
DPS-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Develop a climate strategy that addresses simultaneously the reduction of fossil fuels and the protection of forestlands.	3	15	Academic, NWFSC, State, SWFSC,	For example, promote biological carbon sequestration best management practices (BMPs), where feasible, that are consistent with NMFS policies and guidelines. Develop incentives to maintain and rehabilitate forestlands, manage for older forests, discourage conversions or forest changes. Forestlands store carbon and reduce greenhouse gases.
DPS-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Expand research and monitoring to improve predictions of climate change and its effects on salmon recovery.	2	15	Academic, NWFSC, State, SWFSC,	Tools such as the Regional Climate System Model, Sea Level Rise and Coastal Flooding Impacts Viewer, etc. should be used to improve ecological forecasting of the threat of climate change, human population growth, and their impacts to salmonids and their habitats.
DPS-NCSW-24.1.1.4	Action Step	Severe Weather Patterns	Minimize anthropogenic increases in water temperatures by maintaining well-shaded riparian areas. Work to encourage and incorporate climate change vulnerability assessments and climate change scenarios in consultations, permitting, and restoration projects.	2	50	CDFW, Corps County, NMFS, NOAA RC, State	
DPS-NCSW-24.1.1.5	Action Step	Severe Weather Patterns	Maintain headwater areas in an undisturbed state to ensure a continuous source of cool water downstream.	1	50	CDFW, Corps, County, NMFS, NOAA RC, State	
DPS-NCSW-24.1.1.6	Action Step	Severe Weather Patterns	Maximize connectivity, and increase diversity, of instream habitats to allow a full range of opportunities for salmonids to exploit as environmental conditions shift.	2	100	CDFW, County, NMFS, State	
DPS-NCSW-24.1.1.7	Action Step	Severe Weather Patterns	Evaluate feasibility and benefits of establishing an Emergency Drought Operations Center (similar to the Emergency Drought Operations Center developed in Washington State), comprised of the SWRCB, CDFW, NMFS, and others to develop emergency rules for augmenting water supplies and mitigating the effects of drought and extreme climate listed salmonids and their habitats.	2	5	CDFW, NMFS, SWRCB	
DPS-NCSW-24.1.1.8	Action Step	Severe Weather Patterns	Institute water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	1	50	CDFW, DWR, Local Government, Private Landowners, NMFS, SWRCB	

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-24.1.1.9	Action Step	Severe Weather Patterns	Partner with land owners and local governments to explore the use of groundwater sources with high yield, such as Karst formations, and manage them as groundwater storage/banking, particularly during drought periods, or for adverse climate change conditions.	3	50	DWR, Local Government, Private Landowners, NMFS, USGS	
DPS-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to estuarine quality and extent				
DPS-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Investigate the potential impact of sea level rise from climate change on the amount of salinity intrusion into fresh and brackish water habitats.	2	15	Academic, NWFSC, State, SWFSC,	
DPS-NCSW-25.1	**Objective**	**Water Diversion/Impoundments**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DPS-NCSW-25.1.1	Recovery Action	Water Diversion/Impoundments	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-25.1.1.1	Action Step	Water Diversion/Impoundments	Encourage cooperation among water users and coordination of their diversions where they share a common water source to minimize adverse effects of diversions on the species' habitat.	2	50	Private Landowners, NGO, NMFS, SWRCB	
DPS-NCSW-25.1.1.2	Action Step	Water Diversion/Impoundments	Work with partners to promote and build water storage as an alternative to direct diversion during periods of low stream flow.	2	50	Private Landowners, NGO, NMFS, SWRCB	The off-stream storage can also be used to store water for fish and then release it in times of low-flow. See also Hydrology
DPS-NCSW-25.1.1.3	Action Step	Water Diversion/Impoundments	Support projects that provide rainwater catchment systems to rural residential as an alternative to summer riparian diversions.	2	50	Private Landowners, NGO, NMFS	
DPS-NCSW-25.1.1.4	Action Step	Water Diversion/Impoundments	Partner with water rights holders to dedicate water already claimed under existing appropriative right to be used instead for instream benefits under California Water Code Section 1707.	2	50	CDFW, Private Landowners, NMFS, SWRCB	
DPS-NCSW-25.1.1.5	Action Step	Water Diversion/Impoundments	Explore the possibility of using other easement mechanisms to dedicate water to instream uses.	2	50	CDFW, NMFS, SWRCB	
DPS-NCSW-25.1.1.6	Action Step	Water Diversion/Impoundments	Support temporary urgency change petitions by appropriative water right holders during critically dry periods if it will provide a benefit to salmonids.	2	50	CDFW, NMFS, SWRCB	
DPS-NCSW-25.1.1.7	Action Step	Water Diversion/Impoundments	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	50	CDFW, NMFS, Private Landowners, SWRCB	
DPS-NCSW-25.1.1.8	Action Step	Water Diversion/Impoundments	Support improvement of major dam/reservoir operations. Evaluate water release schedules and work with partners to modify as needed to improve conditions for salmonids downstream.	1	50	CDFW, NMFS, Public Works, Water Agencies, SWRCB	
DPS-NCSW-25.1.1.9	Action Step	Water Diversion/Impoundments	Support technical solutions to improved short-term precipitation forecasting where such information will facilitate more efficient management of reservoir storage.	3	50	NMFS, NOAA NWS	
DPS-NCSW-25.2	**Objective**	**Water Diversion/Impoundments**	**Address the inadequacy of existing regulatory mechanisms**				
DPS-NCSW-25.2.1	Recovery Action	Water Diversion/Impoundments	Prevent or minimize impairment to watershed hydrology				
DPS-NCSW-25.2.1.1	Action Step	Water Diversion/Impoundments	Encourage the SWRCB to exercise greater regulatory authority over summer water diversions.	2	50	CDFW, NMFS, SWRCB	
DPS-NCSW-25.2.1.2	Action Step	Water Diversion/Impoundments	Work with the SWRCB and explore the feasibility of upgrading bypass flow conditions for water rights developed prior to the establishment of AB 2121.	2	10	NMFS, Private Landowners, Public Works, Water Agencies, SWRCB	
DPS-NCSW-25.2.1.3	Action Step	Water Diversion/Impoundments	Support State agencies in implementing groundwater legislation (AB 1739, SB 1168, and SB 1319) where it may result in improved surface water conditions via groundwater/surface water interaction.	2	10	County, DWR, NMFS, Private Landowners, Public Works, Water Agencies	

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Action ID	Targeted Attribute or Threat	Level	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DPS-NCSW-25.2.1.4	Action Step	Water Diversion/Impoundments	Improve coordination between the agencies, particularly the SWRCB and county District Attorneys, to effectively identify and address illegal water diverters and out-of-compliance diverters, seasons of diversion, off-stream reservoirs, and bypass flows to protect listed salmonids.	1	5	County, NMFS, Private Landowners, Public Works, Water Agencies, SWRCB	
DPS-NCSW-25.2.1.5	Action Step	Water Diversion/Impoundments	Evaluate the recovery benefits of declaring some watersheds as fully appropriated and petition the SWRCB to formally declare it if appropriate.	2	10	NMFS, SWRCB	
DPS-NCSW-25.2.1.6	Action Step	Water Diversion/Impoundments	Provide technical assistance to the SWRCB in its implementation of the frost protection regulation.	2	10	Agriculture Owners, County, NMFS, Private Landowners, SWRCB	
DPS-NCSW-25.2.1.7	Action Step	Water Diversion/Impoundments	Encourage the SWRCB to conduct interagency consultation with CDFW, and seek technical assistance from NMFS on the issuance of water rights permits.	2	10	CDFW, NMFS, SWRCB	
DPS-NCSW-25.2.1.8	Action Step	Water Diversion/Impoundments	Counties should consider forbearance agreements that eliminate withdrawals during low-flow conditions.	2	5	CDFW, County, NMFS, Private Landowners, SWRCB	
DPS-NCSW-25.2.1.9	Action Step	Water Diversion/Impoundments	Coordinate with CDFW and the SWRCB to ensure the effective implementation of California Fish and Game Code Sections 5935-5937 regarding the provision of fishways and fish flows associated with dams and diversions.	2	5	CDFW, NMFS, SWRCB	
DPS-NCSW-25.2.1.10	Action Step	Water Diversion/Impoundments	Encourage development of a GCP/HCP/Natural Community Conservation Plan (NCCP), conservation banks, or safe harbor agreements for new water diversions in watersheds with essential and supporting populations.	3	5	CDFW, NMFS	
DPS-NCSW-25.2.2	Recovery Action	Water Diversion/Impoundments	Prevent or minimize reduced density, abundance, and diversity based on biological viability criteria				
DPS-NCSW-25.2.2.1	Action Step	Water Diversion/Impoundments	Adequately screen water diversions to prevent juvenile salmonid mortalities.	1	50	CDFW, County, NMFS, Private Landowners	
DPS-NCSW-25.2.2.2	Action Step	Water Diversion/Impoundments	Screen all off stream catchments, ponds, reservoirs with overflows and properly maintain them at all times especially before and after storm events to insure protection of listed species from escaped non-native fish.	2	50	CDFW, County, NMFS, Private Landowners	

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POPULATION LEVEL RESULTS AND RECOVERY ACTIONS

As described in detail in Volume I, Chapter 4 (Methods) of the Plan, NOAA's National Marine Fisheries Service (NMFS) completed the following steps to develop this recovery plan: (1) selected populations for recovery scenarios using the framework provided by Bjorkstedt et al. (2005) and Spence et al. (2008 and 2012); (2) assessed current watershed habitat conditions; (3) identified ongoing and future stresses and threats to these populations and their habitats; and (4) developed site-specific and range-wide recovery actions. For each population identified as essential or supporting, we summarized the best available information from a variety of sources into a narrative that describes the species abundance and distribution, the history of land use, land management and current resources, and descriptions of the results of our analyses of current conditions and future threats.

Populations were selected using a variety of criteria defined primarily by the Technical Recovery Team (Spence et al. 2008 and 2012), including extinction risk, population size, unique life history traits, connectivity between populations, habitat suitability, etc. Essential populations are those expected to achieve a high probability of persisting over long periods of time (low risk of extinction), while additional supporting populations are expected to either achieve a moderate probability of persisting (moderate risk of extinction) or to provide ESU/DPS stability by providing connectivity and redundancy.

For each population, we estimated the amount of accessible habitat area (in kilometers). Estimates are based on a model that uses stream gradient, channel width, and discharge to define the area with the intrinsic potential (IP-km) to support salmonids (Bjorkstaedt et al. 2005). Where natural barriers, steep gradient changes, or stream flow dynamics were undetected by the model or where regional experts deemed areas unlikely to support spawning (e.g., ephemeral reaches, reaches inundated by reservoirs or estuaries, or highly modified and irretrievable reaches), we made appropriate changes to modeled IP. Using the Spence et al. (2008 and 2012) criteria and any revisions to IP habitat, spawner targets for each population were calculated using formulas for viable populations.

Current watershed conditions and threats for essential and supporting populations were assessed using a method called Conservation Action Planning (CAP) (TNC 2007). Conditions and threats were analyzed using a detailed set of spatial and ecological parameters described in Appendix D.

The essential populations were analyzed using the full CAP protocol and individual CAP workbooks. These detailed analyses identified an array of watershed habitat conditions, and ranked them using specific indicators developed from literature review. Similarly, future threats were ranked based on available data and knowledge of the watersheds (Appendix D). The supporting populations were analyzed using an abbreviated rapid assessment protocol based on the CAP protocol. These populations were analyzed in groups of ecologically similar Diversity Strata as defined by Spence et al. (2008 and 2012). The rapid assessments utilized a subset of the factors analyzed in the full CAP protocol.

Where we identified poor watershed conditions or high or very high threats, we identified recovery actions to improve conditions and abate/reduce a threats. We organized actions into three levels: Objective, Recovery Action and Action Step. Objectives link the Recovery Actions and Action Steps to the five listing factors. Organizing actions and actions steps to a specific listing factor allows improved and more direct tracking of the listing factors overtime. Recovery Actions were designed in general terms to improve conditions or abate specific threats. If actions were broad in scope (e.g., work with State Water Resources Control Board), they were incorporated into the Stratum or ESU/DPS level actions. Action steps are the most site-specific restoration or threat abatement action needed and are written to address a specific recovery action. Action steps include additional required information such as cost, priority, etc.

For each action step, additional information was included such as the estimated time to implement the action, estimated costs, and likely recovery partners who could contribute to implementing the action.

We present recovery actions in detailed implementation tables for each population and assign each action step as priority 1, 2, or 3. Priority 1 actions must be taken to prevent extinction, or to identify actions needed to prevent extinction (55 FR 24296, June 15, 1990). Priority 2 actions must be taken to prevent significant decline in population numbers, habitat quality, or other significant negative impacts short of extinction. Priority 3 actions include all other actions necessary to provide for full recovery of the species.

Populations are organized by Diversity Strata and then alphabetical within the Diversity Stratum (See Table of Contents).

Eel River Watershed Overview for NC Steelhead

The following functionally independent and potentially independent populations of the Eel River (Spence *et al*. 2012), selected to achieve a low extinction risk for recovery scenarios, were assessed using the CAP protocols:

Essential Populations

- South Fork Eel River (Functionally Independent)
- Van Duzen River (Functionally Independent)
- Middle Fork Eel River (Functionally Independent)
- North Fork Eel River (Functionally Independent)
- Upper Mainstem Eel River (Functionally Independent)
- Tomki Creek (Functionally Independent)
- Larabee Creek (Potentially Independent)
- Chamise Creek (Potentially Independent)
- Woodman Creek (Potentially Independent)
- Outlet Creek (Functionally Independent)

In addition, a number of potentially independent populations of the Eel River were selected for recovery scenarios to attain moderate extinction risk criteria and the dependent populations were selected for recovery scenarios to meet redundancy and occupancy criteria; these populations were assessed using the Rapid Assessment protocols:

Supporting Populations

- Lower Interior/North Mountain Interior Rapid Assessment
    - Bell Springs Creek (Potentially Independent)
    - Bucknell Creek (Potentially Independent)
    - Dobbyn Creek (Potentially Independent)
    - Garcia Creek (Dependent)
    - Jewett Creek (Potentially Independent)
    - Soda Creek (Dependent)

- North Coastal Diversity Stratum: Eel River Rapid Assessment
    - Lower Mainstem Eel River Tributaries[1] (Dependent)
    - Howe Creek (Dependent)

The following sections provide a general overview of the abundance and distribution of NC steelhead, history of land use, current resources and land management, and a brief summary of the CAP viability, stresses, and threats results for the Eel River Watershed.

Abundance and Distribution

Information on the historic abundance and distribution of adult steelhead in the Eel River watershed are limited and poorly understood. Historically, winter-run (winter) steelhead are thought to have spawned and reared in the mainstem and tributary streams of all major subbasins in the Eel River Watershed. The distribution of summer-run (summer) steelhead was less extensive with populations primarily located in the Middle Fork, Van Duzen, and North Fork subbasins (Moyle *et al.* 2008). Like other coastal populations throughout California, steelhead use of the Eel River estuary was undoubtedly extensive with multiple life stages utilizing the estuary throughout the year. The construction of Scott Dam (1922) eliminated significant portions of historic spawning habitat for steelhead in the Upper Mainstem Eel River including "*some of the best spawning grounds in the entire watershed (Gravelly Valley)* (Shapovalov 1939)." Aside from the loss of habitat upstream of Scott Dam and within reaches flooded by both Van Arsdale Reservoir and Lake Pillsbury, steelhead remain widely distributed throughout the Eel River Watershed.

Based on amount of historic habitat available in the watershed, Yoshiyama and Moyle (2010) estimate the historic run size ranged between 100,000 and 150,000 adults per year for both the winter and summer populations. There are two long-term data series of adult returns to the Eel River Watershed—ladder counts at the Van Arsdale Fisheries Station (VAFS) located at Cape

[1] The Lower Mainstem Eel River includes a set of small tributaries to the lower mainstem of the Eel River.

Horn Dam on the Upper Mainstem Eel River (Figure 1), and counts at Benbow Dam on the South Fork Eel River (Figure 2). Based on these records, and assuming the historic run size estimates above, steelhead runs in the Eel River watershed have declined substantially with a precipitous decline since the 1950s. Annual counts at VAFS averaged 4,394 in the 1930's, which declined to 731 during the 1970's (Figure 1). Similarly, on the South Fork Eel River, adult returns at Benbow Dam in the 1940s averaged 18,800 fish, which declined to an average of 3,400 fish during the 1970s (Figure 2). For summer steelhead, the decline in abundance is equally as significant. CDFG (1997) noted that recent counts were approximately 80 to 90 percent lower than counts made in the 1930s and 1940s.

Recent data of steelhead adult returns to the Eel River Watershed are limited primarily to counts at the VAFS on the Upper Mainstem and dive counts of summer steelhead adults in the Middle Fork Eel River. Overall, the trend of adult returns at VAFS is negative with recent counts well below the peak counts from the 1930s and 1940s. There is a strong hatchery influence as well. Between 1997 and 2007, more than 90% of adult steelhead returns at VAFS were of hatchery origin, although the trend in wild fish has been positive over the past 14 years (Williams *et al.* 2011). Nevertheless, the Upper Mainstem Eel River population remains highly impacted and the overall population is at high risk of extinction (Williams *et al.* 2011). Based on recent counts of summer adults in the Middle Fork Eel River, Williams *et al.* (2011) concluded this population remains at moderate risk of extinction despite recent counts being slightly above low extinction thresholds.

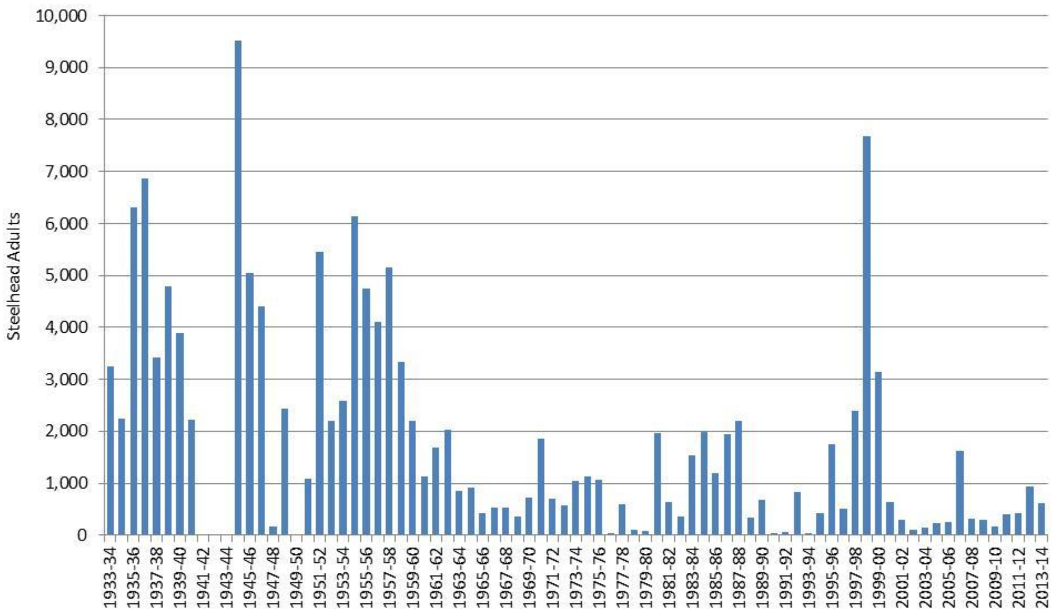

Figure 1: Total adult steelhead returns (origin not identified) counted at the Van Arsdale Fisheries Station on the Upper Mainstem Eel River, 1933-34 through 2013-2014. Data Source: http://www.pottervalleywater.org/van_arsdale_fish_counts.html. No data recorded for the following years: 1941-42, 1942-43, 1943-44 and 1949-50.

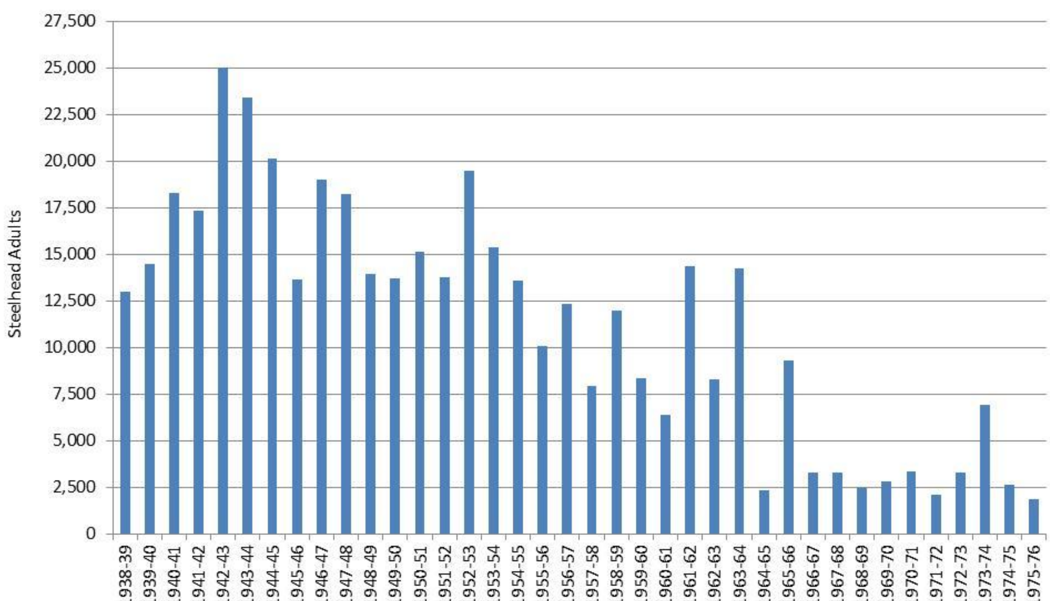

Figure 2: Adult steelhead returns counted at the Benbow Dam Fish Ladder on the South Fork Eel River, 1938-39 through 1975-76. Note all 1964-65 data are estimates due to incomplete records caused the 1964 floods. Counts in 1963-64, 1966-67, and 1969-70 through 1973-74 are estimates as the station was closed before the end of the run.

History of Land Use

The Eel River Watershed is the third largest watershed within California with a drainage area of approximately 3,684 square miles covering four major subbasins (Van Duzen River, South Fork Eel River, North Fork Eel River, and Middle Fork Eel River) and portions of five counties (Figure 3). Due to its size, the topography and climate within the watershed varies. Overall, the climate follows a Mediterranean pattern with cool wet winters, followed by dry and relatively warm summers. In summer, the coastal areas of the watershed typically experience fog while inland areas are dry and much warmer. The watershed is located in a geologically active area and is underlain by Franciscan Formation which is highly erodible, particularly in steep terrain (Kubicek 1977; Yoshiyama and Moyle 2010).

Figure 3: Eel River watershed overview map

Prior to Euro-American settlement, the Eel River Watershed was inhabited by several native groups including the Wiyot, Sinkyone, Lassik, Nongatl, Yuki and Wailaki peoples. While these groups utilized the natural resources of the Eel River Watershed, it is likely their collective impact on the resources or landscape was relatively minor. Euro-American settlement and exploitation of the watershed's natural resources began in the second half of the 19th Century. During this period, most of the low-elevation forested areas were logged and converted to other uses such as dairies and agriculture. The abundant fish populations in the watershed (primarily Chinook salmon), supported a commercial fishery including cannery operations. The canneries operated until 1912 and the commercial fishery was closed by 1926 as salmon numbers declined despite substantial artificial propagation (Yoshiyama and Moyle 2010).

Although logging and fishing continued through the early 20th Century, two of the more significant anthropogenic changes to the watershed during this period were the construction of Cape Horn (1908) and Scott (1922) dams on the Upper Mainstem Eel River (SEC 1998). Unlike Cape Horn, Scott Dam (farther upstream) was constructed without fish passage facilities and therefore blocks a significant amount of potential anadromous salmonid habitat. The dams and impounded reservoirs were built to generate hydro-electric power and provide water south to the Russian River Watershed (NMFS 2002).

Following World War II, much of the remaining virgin forest as well as substantial areas of second-growth forest were logged at a rapid pace throughout the watershed. Logging spread to steeper slopes and remote areas which required development of a vast network of mostly poorly constructed roads. The removal of vegetation and road construction increased sediment erosion on an unprecedented scale. The large floods in 1955 and 1964 exacerbated the erosion and caused significant sedimentation within the Eel River, its tributaries, and the estuary. Deep pools that were common in the river channels were mostly filled in and most of the riparian vegetation was eliminated. While some areas have improved since the floods, legacy effects of the logging and floods remains in many areas of the watershed, which contribute to the poor habitat quality evident throughout much of the watershed today.

Throughout the 20th Century, both Chinook salmon and steelhead were propagated and released into the Eel River. For Chinook salmon, most of the eggs and fry were harvested from out-of-basin stocks (Sacramento and Trinity basins) (Yoshiyama and Moyle 2010). Prior to 1920, all steelhead released in the Eel River were of native stock (SEC 1998). After 1981, all Chinook salmon planted in the Eel River Watershed were of native origin. The impacts of the hatchery practices on the genetic integrity and population status are unknown or poorly understood due to insufficient information (SEC 1998; Yoshiyama and Moyle 2010).

In 1980, predatory Sacramento pikeminnow were introduced into Lake Pillsbury (CDFG 1997), and are now found throughout the Eel River watershed. Based on recent surveys by the California Department of Fish and Wildlife (CDFW), Sacramento pikeminnow are present in large numbers in Lake Pillsbury, and many of the larger tributaries that drain into the lake such as the mainstem Eel River, and much of the Rice Fork system (S. Harris, CDFW, personal communication, 2013).

Current Resources and Land Management

Approximately 67% of the Eel River Watershed is privately owned, 30% managed as federal lands, and 3% managed as state lands. A majority of the federally managed lands are within the Six Rivers National Forest and the Yolla Bolly-Middle Eel Wilderness Area. Approximately 60,000 acres of the watershed is managed under the State of California Department of Parks and Recreation, much of which is within Humboldt Redwoods State Park. In 1981, portions of the Eel River and its major tributaries (a total 398 miles) were designated under the National Wild and Scenic River system.

Nearly 75% of the watershed is forested with Douglas fir (27%), montane hardwood (26%), and Coast redwood (10%) being the most common forest communities. Urban areas represent less than 1% of the watershed area with the largest developments located near the coast and extreme headwaters. In addition to parks and other recreational areas, logging, grazing, and agriculture are the primary land uses in the watershed.

The Eel River Estuary

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of all Eel River salmonid populations. Currently, the Eel River estuary is severely impaired due to past diking and filling of tidal wetlands for agriculture and flood protection. Approximately 60% of the estuary has been lost through the construction of levees and dikes, and CDFG (2010) estimated only 10% of historic salt marsh habitat remains today. The function of the estuary (*e.g.*, rearing, refugia, ocean transition) for Eel River salmonids is particularly important given the degraded habitat conditions and predation and competition from non-native Sacramento pikeminnow in the mainstem Eel River. Juveniles and smolts suffer from the lost opportunity for increased growth, which affects their survival at ocean entry. The quantity and quality of estuary habitat available to salmonids in the Eel River is expected to expand in the near future due to the Salt River Ecosystem Restoration Project and restoration efforts on the The Wildland Conservancy's Eel River Estuary Preserve and CDFW's Ocean Ranch Unit of the Eel River Wildlife Area.

Salmonid Viability and Habitat Conditions

A summary of attributes and indicator ratings for Eel River populations of NC steelhead are presented in Table 1 and Table 2. Across the Eel River Watershed, attribute indicators frequently rated Poor for multiple populations and life stages were:

- Estuary: Quality and Extent;
- Habitat Complexity: Large Wood and Shelter;
- Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios;
- Hydrology: Baseflow & Number, Condition and/or Magnitude of Diversions;
- Riparian Vegetation: Canopy Cover and Tree Diameter;
- Sediment: Gravel Quality and Distribution of Spawning Gravels;
- Sediment Transport: Road Density and Streamside Road Density;
- Viability: Density, Abundance and Spatial Structure; and
- Water Quality: Temperature and Turbidity

Across all populations in the Eel River Watershed, summer rearing juveniles are the most impaired life stage with 85% of attribute indicators rated Poor or Fair and 45% rated as Poor alone (Figure 3). Winter rearing juveniles are a close second with 82% of attribute indicators rated Poor or Fair, of which 39% were rated Poor. Of the Watershed Processes, streamside road density was identified as the most significant impact to instream and riparian habitat quality with all populations rated Poor (Table 2). Timber harvest was also rated Poor for the Larabee Creek and Van Duzen River populations. The extent and impact of impervious surfaces, urban development, and agriculture are minimal as all populations were rated Fair or better with most rated Very Good.

With the exception of the South Fork Eel River (North Coastal Diversity Stratum), all other populations represent the entirety of the Lower Interior and North Mountain Interior Diversity Strata, which includes the upper portions of the Mad River and Redwood Creek watersheds (Bjorkstedt *et al.* 2005). The DPS and Diversity Strata results from the CAP viability analysis are described in greater detail in the section above, NC steelhead CAP results. Population-specific results are described below in the population profiles and rapid assessments.

Table 1: NC steelhead DPS CAP Viability Summary by Attribute for Eel River populations.

NC Steelhead Population Conditions By Habitat Attribute			N.C.	Lower Interior				North Mountain Interior				
Target	Attribute	Indicator	South Fork Eel River	Chamise Creek	Woodman Creek	Outlet Creek	Tomki Creek	Van Duzen River	Larabee Creek	North Fork Eel River	Middle Fork Eel River	Upper Mainstem Eel River
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	P	P	P	P	P	P	P	P	P
Smolts	Estuary/Lagoon	Quality & Extent	P	P	P	P	P	P	P	P	P	P
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	F	F	P	P	P	F	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	F	F	P	P	P	F	F	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	F	F	P	P	P	F	F	F	P	P
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	P	P	P	P	F	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	P	P	P	P	F	F	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	P	P	P	P	F	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	F	F	P	P	P	P	F	P	P	P
Summer Adults	Habitat Complexity	Percent Staging Pools	F	NA	NA	NA	NA	P	NA	P	G	F
Winter Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	V	F	P	F	F	P	P	F
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	V	F	P	F	F	P	P	P
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	V	F	P	F	F	P	P	F
Winter Adults	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	F	P	P	F
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	P	P	P	F
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	F	P	P	F
Smolts	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	F	P	P	P
Summer Adults	Habitat Complexity	Shelter Rating	P	NA	NA	NA	NA	P	NA	P	P	F
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	P	F	F	P	P	P	F	P	F	G
Summer Adults	Hydrology	Flow Conditions (Baseflow)	P	NA	NA	NA	NA	P	NA	P	G	G
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	G	F	F	G	G	G	V	V	G	G
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	F	F	F	P	F	F	F	F	F	F
Watershed Processes	Hydrology	Impervious Surfaces	V	V	V	V	V	V	V	V	V	V
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	P	V	G	P	F	P	F	G	F	F
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	F	V	G	F	F	P	F	G	G	G
Winter Adults	Hydrology	Passage Flows	G	F	F	F	G	G	G	G	G	G
Smolts	Hydrology	Passage Flows	F	F	G	F	G	F	G	F	G	P
Summer Adults	Hydrology	Passage Flows	F	NA	NA	NA	NA	P	NA	G	G	G
Eggs	Hydrology	Redd Scour	F	F	F	G	F	F	F	G	F	F
Watershed Processes	Landscape Patterns	Agriculture	V	V	V	F	V	F	G	V	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	G	V	V	G	V	P	P	V	V	V
Watershed Processes	Landscape Patterns	Urbanization	V	V	V	F	F	V	V	V	V	V
Winter Adults	Passage/Migration	Passage at Mouth or Confluence	G	G	G	F	G	G	G	G	G	G
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	P	F	G	F	F	F	G	F	F	P
Smolts	Passage/Migration	Passage at Mouth or Confluence	F	G	G	G	F	F	F	P	G	G
Summer Adults	Passage/Migration	Passage at Mouth or Confluence	P	NA	NA	NA	NA	F	NA	G	G	F
Winter Adults	Passage/Migration	Physical Barriers	V	V	P	F	V	V	V	V	G	P
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	F	P	V	G	V	V	G	F
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	V	G	G	F	V	G	V	V	G	F
Summer Adults	Passage/Migration	Physical Barriers	V	NA	NA	NA	NA	V	NA	F	F	P
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	F	P	V	F	P	P	P	P	F	F
Watershed Processes	Riparian Vegetation	Species Composition	F	F	F	F	F	V	G	F	G	F
Winter Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	P	P	P	F	P	P	P	F
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	P	P	P	F	P	P	P	F
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	P	P	P	F	P	P	P	F
Eggs	Sediment	Gravel Quality (Bulk)	P	F	F	F	F	P	G	F	P	F
Summer Adults	Sediment	Gravel Quality (Bulk)	P	NA	NA	NA	NA	P	NA	F	P	F
Eggs	Sediment	Gravel Quality (Embeddedness)	F	P	P	P	F	P	F	F	P	F
Summer Adults	Sediment	Gravel Quality (Embeddedness)	F	NA	NA	NA	NA	P	NA	F	P	F
Winter Adults	Sediment	Quantity & Distribution of Spawning Gravels	G	F	P	G	G	P	F	F	G	G
Summer Adults	Sediment	Quantity & Distribution of Spawning Gravels	G	NA	NA	NA	NA	P	NA	F	G	G
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	P	P	F	F	P	F	F	P	P
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	P	P	F	F	P	F	F	P	P
Watershed Processes	Sediment Transport	Road Density	P	G	G	F	G	P	P	F	V	F
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	P	P	P	P	P
Smolts	Smoltification	Temperature	P	F	G	F	F	F	G	P	F	F
Winter Adults	Velocity Refuge	Floodplain Connectivity	F	F	G	P	G	F	G	G	F	F
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	F	G	G	P	F	F	G	G	F	G
Summer Adults	Velocity Refuge	Floodplain Connectivity	F	NA	NA	NA	NA	F	NA	G	F	F
Smolts	Viability	Abundance	G	F	P	F	P	F	F	F	F	P
Summer Adults	Viability	Abundance	P	NA	NA	NA	NA	F	NA	P	F	P
Winter Adults	Viability	Density	F	P	F	F	P	F	F	G	F	P
Summer Rearing Juveniles	Viability	Density	F	P	P	F	P	F	F	F	F	F
Summer Rearing Juveniles	Viability	Spatial Structure	V	V	G	F	P	G	V	G	F	P
Summer Adults	Water Quality	Mainstem Temperature (MWMT)	P	NA	NA	NA	NA	F	NA	P	F	F
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	P	P	F	P	P	F	P	P	F	P
Winter Adults	Water Quality	Toxicity	F	G	F	F	G	F	G	G	F	F
Summer Rearing Juveniles	Water Quality	Toxicity	F	G	F	F	F	F	G	G	F	V
Winter Rearing Juveniles	Water Quality	Toxicity	F	G	F	F	G	F	G	G	F	F
Smolts	Water Quality	Toxicity	F	G	F	F	G	F	G	G	F	V
Summer Adults	Water Quality	Toxicity	F	NA	NA	NA	NA	F	NA	G	G	V
Winter Adults	Water Quality	Turbidity	P	P	F	F	F	P	F	F	F	F
Summer Rearing Juveniles	Water Quality	Turbidity	P	F	F	F	F	P	G	G	G	F
Winter Rearing Juveniles	Water Quality	Turbidity	P	P	F	F	F	P	F	F	F	F
Smolts	Water Quality	Turbidity	F	F	F	F	F	P	F	F	F	F

Table 2: NC steelhead DPS CAP Viability Summary by Life Stage for Eel River populations.

NC Steelhead Population Conditions By Target Life Stage			N.C.	Lower Interior				North Mountain Interior				
Target	Attribute	Indicator	South Fork Eel River	Chamise Creek	Woodman Creek	Outlet Creek	Tomki Creek	Van Duzen River	Larabee Creek	North Fork Eel River	Middle Fork Eel River	Upper Mainstem Eel River
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	F	F	P	P	P	F	F	F	P	P
Winter Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	P	P	P	P	F	F	F	P	P
Winter Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	V	F	P	F	F	P	P	F
Winter Adults	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	F	P	P	F
Winter Adults	Hydrology	Passage Flows	G	F	F	F	G	G	G	G	G	G
Winter Adults	Passage/Migration	Passage at Mouth or Confluence	G	G	G	F	G	G	G	G	G	G
Winter Adults	Passage/Migration	Physical Barriers	V	V	P	F	V	V	V	V	G	P
Winter Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	P	P	P	F	P	P	P	F
Winter Adults	Sediment	Quantity & Distribution of Spawning Gravels	G	F	P	G	G	P	F	F	G	G
Winter Adults	Velocity Refuge	Floodplain Connectivity	F	F	G	P	G	F	G	G	F	F
Winter Adults	Water Quality	Toxicity	F	G	F	F	G	F	G	G	F	F
Winter Adults	Water Quality	Turbidity	P	P	F	F	F	P	F	F	F	F
Winter Adults	Viability	Density	F	P	F	F	P	F	F	G	F	P
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	G	F	F	G	G	G	V	V	G	G
Eggs	Hydrology	Redd Scour	F	F	F	G	F	F	F	G	F	F
Eggs	Sediment	Gravel Quality (Bulk)	P	F	F	F	F	P	G	F	P	F
Eggs	Sediment	Gravel Quality (Embeddedness)	F	P	P	P	F	P	F	F	P	F
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	P	P	P	P	P	P	P	P	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	F	F	P	P	P	F	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	P	P	P	P	F	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	F	F	P	P	P	P	F	P	P	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	V	F	P	F	F	P	P	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	P	P	P	F
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	P	F	F	P	P	P	F	P	F	G
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	F	F	F	P	F	F	F	F	F	F
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	P	V	G	P	F	P	F	G	F	F
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	P	F	G	F	F	F	G	F	F	P
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	F	P	V	G	V	V	G	F
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	F	P	V	F	P	P	P	P	F	F
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	P	P	P	F	P	P	P	F
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	P	P	F	F	P	F	F	P	P
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	P	P	F	P	P	F	P	P	F	P
Summer Rearing Juveniles	Water Quality	Toxicity	F	G	F	F	F	F	G	G	F	V
Summer Rearing Juveniles	Water Quality	Turbidity	P	F	F	F	F	P	G	G	G	F
Summer Rearing Juveniles	Viability	Density	F	P	P	F	P	F	F	F	F	F
Summer Rearing Juveniles	Viability	Spatial Structure	V	V	G	F	P	G	V	G	F	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	F	F	P	P	P	F	F	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	P	P	P	P	F	F	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	V	F	P	F	F	P	P	F
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	F	P	P	F
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	V	G	G	F	V	G	V	V	G	F
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	F	P	P	P	F	P	P	P	F
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	P	P	F	F	P	F	F	P	P
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	F	G	G	P	F	F	G	G	F	G
Winter Rearing Juveniles	Water Quality	Toxicity	F	G	F	F	G	F	G	G	F	F
Winter Rearing Juveniles	Water Quality	Turbidity	P	P	F	F	F	P	F	F	F	F
Smolts	Estuary/Lagoon	Quality & Extent	P	P	P	P	P	P	P	P	P	P
Smolts	Habitat Complexity	Shelter Rating	P	P	P	P	P	P	F	P	P	P
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	F	V	G	F	F	P	F	G	G	G
Smolts	Hydrology	Passage Flows	F	F	G	F	G	F	G	F	G	P
Smolts	Passage/Migration	Passage at Mouth or Confluence	F	G	G	G	F	F	F	P	G	G
Smolts	Smoltification	Temperature	P	F	G	F	F	F	G	P	F	F
Smolts	Water Quality	Toxicity	F	G	F	F	G	F	G	G	F	V
Smolts	Water Quality	Turbidity	F	F	F	F	F	P	F	F	F	F
Smolts	Viability	Abundance	G	F	P	F	P	F	F	F	F	P
Watershed Processes	Hydrology	Impervious Surfaces	V	V	V	V	V	V	V	V	V	V
Watershed Processes	Landscape Patterns	Agriculture	V	V	V	F	V	F	G	V	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	G	V	V	G	V	P	P	V	V	V
Watershed Processes	Landscape Patterns	Urbanization	V	V	V	F	F	V	V	V	V	V
Watershed Processes	Riparian Vegetation	Species Composition	F	F	F	F	F	V	G	F	G	F
Watershed Processes	Sediment Transport	Road Density	P	G	G	F	G	P	P	F	V	F
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	P	P	P	P	P
Summer Adults	Habitat Complexity	Percent Staging Pools	F	NA	NA	NA	NA	P	NA	P	G	F
Summer Adults	Habitat Complexity	Shelter Rating	P	NA	NA	NA	NA	P	NA	P	P	F
Summer Adults	Hydrology	Flow Conditions (Baseflow)	P	NA	NA	NA	NA	P	NA	P	G	G
Summer Adults	Hydrology	Passage Flows	F	NA	NA	NA	NA	P	NA	G	G	G
Summer Adults	Passage/Migration	Passage at Mouth or Confluence	P	NA	NA	NA	NA	F	NA	G	G	F
Summer Adults	Passage/Migration	Physical Barriers	V	NA	NA	NA	NA	V	NA	F	F	P
Summer Adults	Sediment	Gravel Quality (Bulk)	P	NA	NA	NA	NA	P	NA	F	P	F
Summer Adults	Sediment	Gravel Quality (Embeddedness)	F	NA	NA	NA	NA	P	NA	F	P	F
Summer Adults	Sediment	Quantity & Distribution of Spawning Gravels	G	NA	NA	NA	NA	P	NA	F	G	G
Summer Adults	Velocity Refuge	Floodplain Connectivity	F	NA	NA	NA	NA	F	NA	G	F	F
Summer Adults	Water Quality	Mainstem Temperature (MWMT)	P	NA	NA	NA	NA	F	NA	P	F	F
Summer Adults	Water Quality	Toxicity	F	NA	NA	NA	NA	F	NA	G	G	V
Summer Adults	Viability	Abundance	P	NA	NA	NA	NA	F	NA	P	F	P

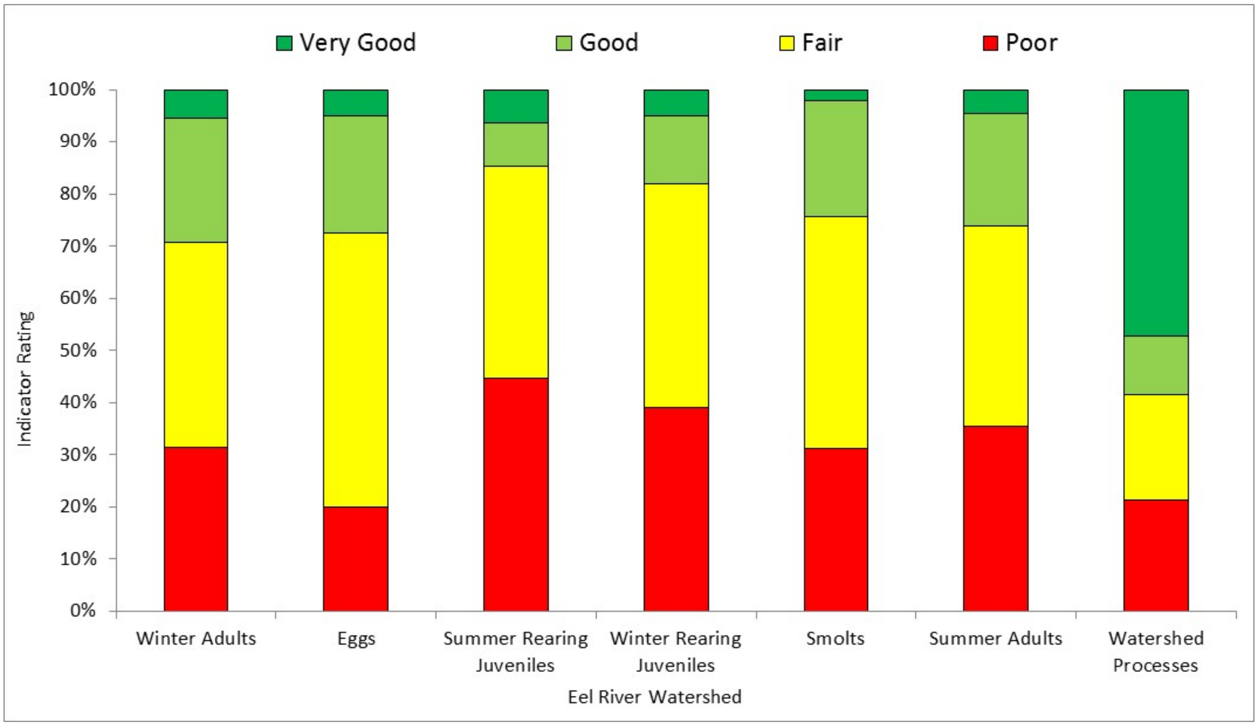

Figure 4: CAP Attribute Indicator ratings for the NC steelhead life stages in the Eel River Watershed.

Threats

Table 3 summarizes the CAP threat results across the Eel River populations. The threat of greatest concern throughout the Eel River Watershed is Roads and Railroads, with 7 of 10 populations rated High and the 3 remaining populations rated Medium. This was followed by Water Diversions and Impoundments which was the only threat with a Very High rating (Upper Mainstem Eel River) in addition to four populations with High ratings (South Fork Eel River, Outlet Creek, Tomki Creek, and Van Duzen River). Other threats rated High were Channel Modification (South Fork Eel River and Van Duzen River), Disease, Predation, and Competition (Van Duzen River), Fishing and Collecting (Van Duzen River and Middle Fork Eel River), and Fire, Fuel Management and Fire Suppression (Middle Fork Eel River). Population-specific results of threats and actions to ameliorate them are described in greater detail below under each population profile.

Table 3: NC steelhead Threat Summary Table for Eel River Populations, where L=Low, M=Medium, H=High, and VH=Very High threat. Cells with [-] were not rated or not applicable.

Diversity Strata	N.C	Lower Interior				North Mountain Interior				
NC Steelhead Threat/Population	South Fork Eel River	Chamise Creek	Woodman Creek	Outlet Creek	Tomki Creek	Van Duzen River	Larabee Creek	North Fork Eel River	Middle Fork Eel River	Upper Mainstem Eel River
Agriculture	M	M	L	M	L	M	M	M	M	L
Channel Modification	H	M	M	M	-	H	M	M	M	L
Disease, Predation and Competition	M	M	M	-	M	H	M	M	M	M
Fire, Fuel Management and Fire Suppression	M	L	L	L	L	M	M	M	H	M
Fishing and Collecting	M	L	L	L	L	H	M	M	H	M
Hatcheries and Aquaculture	-	-	-	-	-	-	-	-	-	-
Livestock Farming and Ranching	M	L	L	M	L	M	M	M	M	L
Logging and Wood Harvesting	M	L	L	M	M	M	M	M	M	L
Mining	M	L	L	L	-	M	L	M	L	L
Recreational Areas and Activities	M	L	L	-	L	M	L	M	L	L
Residential and Commercial Development	M	M	M	M	M	M	L	M	L	L
Roads and Railroads	M	H	H	M	M	H	H	H	H	H
Severe Weather Patterns	H	M	M	M	M	M	M	M	M	H
Water Diversion and Impoundments	H	M	M	H	H	H	M	M	M	VH

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Northern Coastal Diversity Stratum

This stratum includes populations of steelhead that spawn in watersheds north of Punta Gorda that have relatively low elevation, receive relatively high amounts of precipitation, and are strongly influenced by coastal climate. For example, Prairie Creek, a tributary to Redwood Creek (Humboldt Co.) is environmentally similar to nearby coastal basins that are not tributary to a larger watershed. The western portion of the South Fork Eel River watershed is exposed to coastal climatic influences, especially in terms of precipitation and coastally mediated temperature. The small basins of the Lost Coast are grouped into this stratum, largely based on the fact that these watersheds abut the Mattole River watershed, and receive high amounts of precipitation.

The populations that have been selected for recovery scenarios are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum, followed by the Rapid Assessment of the Supporting populations:

- Bear River
- Humboldt Bay Tributaries
- Little River (Humboldt Co.)
- Mad River (Lower and Upper)
- Maple Creek/Big Lagoon
- Mattole River
- Redwood Creek (Humboldt Co.) (Lower and Upper)
- South Fork Eel River
- Northern Coastal Diversity Stratum Rapid Assessment
    - Big Creek
    - Big Flat Creek
    - Guthrie Creek
    - Jackass Creek
    - McNutt Gulch

- Oil Creek
- Shipman Creek
- Spanish Creek
- Telegraph Creek
- Northern Coastal Eel River Rapid Assessment
  - Howe Creek
  - Lower Mainstem Eel River Tributaries

NC steelhead Northern Coastal Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting. Redwood Creek and Mad River cross two diversity strata and were broken into an upper and lower to reflect this.

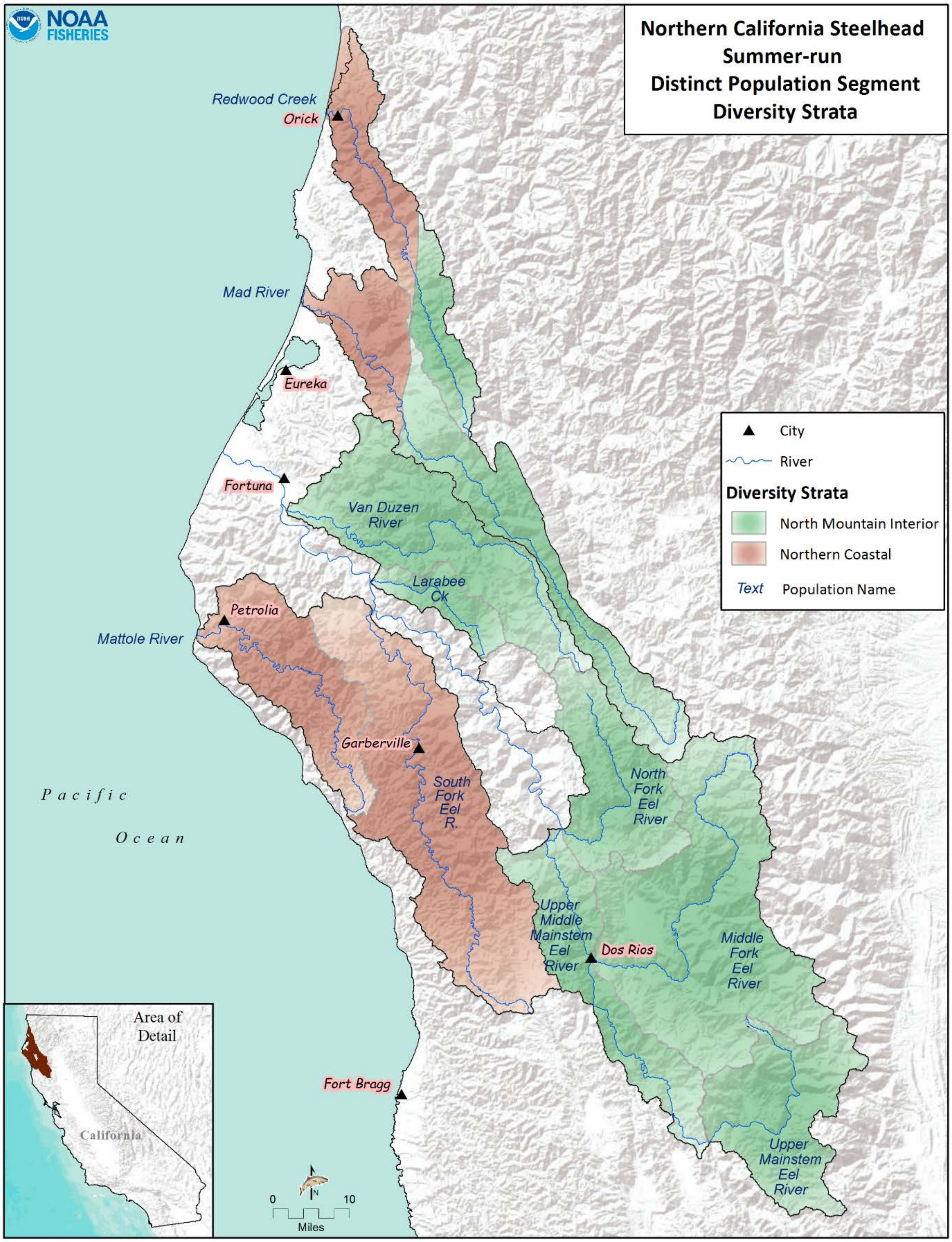
Diversity Stratum	NC steelhead Populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Northern Coastal	Bear River	I	Essential	107.8	27.2	2,900
	Big Creek	D	Supporting	3.8	6-12	21-44
	Big Flat Creek	D	Supporting	5.9	6-12	33-69
	Guthrie Creek	D	Supporting	9.2	6-12	53-108
	Howe Creek	D	Supporting	13.9	6-12	81-165
	Humboldt Bay Tributaries	I	Essential	203.4	20.0	4,100
	Jackass Creek	D	Supporting	6.9	6-12	39-81
	Little River (Humboldt Co.)	I	Essential	50.0	35.3	1,800
	Lower Mainstem Eel River Tributaries	D	Supporting	166.4	6-12	996-1,995
	Mad River (Lower)*	I	Essential	146.3	21.9	3,200
	Maple Creek/Big Lagoon	I	Essential	71.7	32.3	2,300
	Mattole River	I	Essential	534.4	20.0	10,700

	McNutt Gulch	D	Supporting	11.3	6-12	66-134
	Oil Creek	D	Supporting	10.6	6-12	62-125
	Redwood Creek (Humboldt Co) (Lower)*	I	Essential	161.1	20.0	3,200
	Shipman Creek	D	Supporting	2.3	6-12	12-26
	South Fork Eel River	I	Essential	951.8	20.0	19,000
	Spanish Creek	D	Supporting	1.9	6-12	9-21
	Telegraph Creek	D	Supporting	5.3	6-12	30-62
	Northern Coastal Diversity Stratum Recovery Target					**47,200**

NC summer-run steelhead: Diversity Strata, Populations, Historical Population Status, Effective Population Size (N_e). *Although Redwood Creek and Mad River span two diversity strata because so little is known about the population and where they are occurring, they will be treated as one population until more information is gained from monitoring.

Diversity Strata	NC summer-run steelhead populations	Historical Population Status	Effective Population Size
Northern Coastal/ North Mountain Interior	Redwood Creek*	I	$N_e \geq 500$
Northern Coastal/ North Mountain Interior	Mad River*	I	$N_e \geq 500$
Northern Coastal	South Fork Eel River	I	$N_e \geq 500$
Northern Coastal	Mattole River	I	$N_e \geq 500$

NC Winter-Run Steelhead Northern Coastal Diversity Stratum



NC Summer-Run Steelhead Northern Coastal and North Mountain Interior Diversity Strata

Bear River Population

Bear River NC Steelhead (Winter-Run)

- Potentially Independent Population
- North Coastal Diversity Stratum
- Spawner Density Target: 2,900 adults
- Current Intrinsic Potential: 107.8 IP-km

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Juvenile steelhead downstream migrants were estimated during the spring of 2001 (Ricker 2002). Abundance of age 0+, 1+, and 2+ steelhead were estimated to be 64,229 ± 2600 (SD), 26,793 ± 20647, and 21,507 ± 6775 respectively (Ricker 2002). Juvenile steelhead have recently been observed within Beer Bottle, Brushy, Gorge, Harmonica, Peak, Pullen, and Nelson creeks (HRC 2008; 2013). Following the 2007 replacement of a culvert road crossing with a bridge in the Happy Valley area, barriers to fish passage on Humboldt Redwood Company (HRC) lands are limited to natural waterfalls and high gradient channel conditions (HRC 2008).

History of Land Use

Bear River is a fourth order, coastal stream draining approximately 151.5 square kilometers (53,287 acres) to the Pacific Ocean. The connection between the Bear River and the Pacific Ocean is periodically blocked by a temporary sand bar during summer low flow periods. The lagoon-type estuary is approximately one-quarter mile in length (HRC 2008). Since settlement, the two primary land uses in the basin have consisted of grazing and timber harvest. The HRC, formerly Pacific Lumber Company (PALCO), owns 16,537 acres of land in the upper third of the watershed. The remainder of the watershed is in private ownership (36,839 acres), with a small portion (161 acres) owned and managed by the California Department of Parks and Recreation.

The headwaters of the watershed have been managed for timber production since 1950. Early logging operations harvested trees from large tracts and burned residual slash. Most of the trees in the riparian areas were harvested. Logs were skidded downhill with tractors, often utilizing watercourses for skid trails. There was little replanting of harvested sites during the 1950's and 1960's, and site regeneration was left to natural seeding or sprouting save for the retention of small Douglas fir groves. The flood of 1964 altered the morphology of the lower river, transporting large amounts of sediment, removing the majority of the remaining riparian vegetation and decreasing the size and depth of the estuary (HRC 2008).

Land use in the lower watershed has remained predominantly rangeland and is grazed by cattle and sheep. No dams exist in the Bear River drainage, however small water diversions exist throughout the basin for domestic use, livestock watering, irrigation, and dust abatement (road watering).

Since 1998, the California Department of Fish and Wildlife (through the Fisheries Restoration Grants Program-SB 271) has funded ten projects in the Bear River watershed. These have included projects for landowner education, road assessments, water temperature monitoring, riparian enhancement and planting, installation of log structures, installation of fencing for livestock exclusion, and actions to remediate gully erosion and stabilize stream banks.

Current Resources and Land Management

As noted above, the upper third of the Bear River watershed is managed for timber harvest while the lower two-thirds are largely managed as private grazing/ranching lands.

PALCO-HRC Habitat Conservation Plan

The PALCO's Habitat Conservation Plan (HCP) was finalized in 1999 and its associated Incidental Take Permit remains effective through 2049. The HCP was adopted by the HRC upon acquisition of the PALCO lands in 2008. Although the goal of the HCP is to maintain or achieve, over time, a properly functioning aquatic habitat condition, the HCP acknowledges that not all essential habitat elements (*e.g.*, large wood recruitment) will be attainable within the 50-year life of the plan (PALCO 1999). Site-specific prescriptions, which are designed to promote a properly functioning aquatic habitat condition, are contained in the Bear River watershed analysis (HRC 2008).

The Bear River Watershed Analysis was completed in October 2006, and the Hillslope Management and Riparian Management Prescriptions were completed in April, 2007. The hillslope management/mass wasting avoidance strategy uses a three-step approach for the identification and avoidance or mitigation of high hazard unstable areas during the planning and implementation of forestry activities. These steps are: slope stability training; site-specific and project-specific "screening" for unstable areas; and enforceable site-specific prescriptions for road construction, re-construction, or timber harvest on unstable areas designated as "High Hazard." Also required is review and approval of a professional licensed geologist. In general, no timber harvest will occur within the Channel Migration Zone, defined as the flood-prone area in stream reaches with less than 4 percent gradient, which is generally the 100-year floodplain. In addition, all streams will have a Riparian Management Zone (RMZ). The RMZ for Class I (fish-bearing) streams is 150 feet wide, with no timber harvest permitted within the first 50 feet.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, sediment, estuary/lagoon, sediment transport and water quality. Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Bear River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Habitat Complexity: Large Wood & Shelter

Large woody debris (LWD) volume within the mainstem Bear River is generally poor due to the inherently wide bank-full channel width and the high winter flows common to the basin (HRC 2008). Upstream of the Brushy Creek confluence, LWD volume increases as channel dynamics change. Generally speaking, large wood recruitment within the majority of Class I (fish bearing) streams is problematic and will continue to be so for at least the next few decades.

Sediment: Gravel Quality & Distribution of Spawning Gravels

Suitable reaches of the mainstem Bear River, South Fork Bear River, and much of the upper watershed suffer from a high degree of fine sediment embedded within available spawning gravel, which likely reduces salmonid egg and fry survival, impairs invertebrate prey production, and ultimately limits juvenile fish production within the watershed. Both the substrate embeddedness and shallow pool depths common to most low gradient stream reaches are likely caused by upslope erosion from past/current logging practices, failing roads, and poor grazing practices. Juvenile salmonids and eggs are the life stages most impacted by poor gravel quality and excess fine sediment.

Water Quality: Turbidity or Toxicity

The high levels of fine sediment entering the Bear River stream system suggests that elevated turbidity may be an issue following storm events. Highly turbid water can suppress juvenile feeding success and, when severe, physically harm basic physiological processes (*e.g.*, gill respiration).

Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios

Pool depths in the Bear River mainstem average 3.3 feet or greater. However, in the South Fork Bear River and Nelson and Harmonica Creeks, pool depths are 2 feet or less, which is considered a poor condition for salmonid habitat function. Pool frequency throughout the watershed is poor at less than 35 percent by length, caused largely by the lack of instream wood accumulation throughout the mainstem and most larger tributaries. Juvenile steelhead are most impacted by the poor channel complexity because of the lost pool and riffle habitat used for cover and feeding, respectively.

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian forest conditions have an overall Poor rating for juvenile steelhead as well as a Poor rating for landscape processes. High IP habitat in lower Bear River, South Fork Bear River, as well as the upper watershed and its tributaries, generally lacks canopy cover, and available riparian habitat is largely dominated by hardwood species that provide poor shading and little channel-forming function. On HRC lands, current riparian conditions are primarily the result of intensive mid-twentieth century logging and two significant flood events of the same time period. Species composition is primarily a mixture of Douglas-fir, tanoak, red alder, willow, California bay-laurel, and big-leaf maple. Structurally, while groups of large trees in excess of 24" diameter at breast height (dbh) are scattered throughout the Bear River watershed, most stands consist of trees ranging from 11 to 24" dbh. Very little of the HRC owned property meets established targets indicating high LWD recruitment potential (HRC 2008).

Estuary: Quality & Extent

The Bear River estuary is thought to be suffering from changes in sediment loading, water quality, and wood volume (HRC 2008). Fine sediment has accumulated in the estuary, reducing habitat and channel complexity. The lack of LWD and riparian habitat, combined with poor pool volume from sediment aggradation, has decreased the availability of cover refugia for juvenile fish and reduced the extent of the estuary.

Water Quality: Temperatures

Temperature has a Poor rating for summer-rearing juvenile salmonids because water temperatures are often near the upper limit preferred by steelhead (HRC 2008). Although riparian canopy cover is generally adequate throughout the upper basin, much of the Bear River mainstem, and the lower reaches of Harmonica Creek and Gorge Creek, have little over-stream shade canopy (HRC 2008), and summertime water temperatures commonly exceed 17 C. Among four recently monitored sites located throughout the Bear River watershed, only Pullam Creek had a Mean Weekly Average Temperature (MWAT) below the preferred water temperature indicator value of 17 C (HRC 2008).

Viability: Density, Abundance & Spatial Structure

Steelhead juveniles are distributed throughout much of the Bear River watershed (HRC 2008); however, spawner abundance is likely well below the low-risk threshold.

Threats

The following discussion focuses on those threats that rank as High or Very High. Recovery strategies will likely focus on ameliorating High ranking threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Bear River CAP Results.

Logging and Wood Harvesting

Timber harvest is ranked as a High threat to summer rearing and winter rearing juveniles and watershed processes. Legacy effects of past harvest practices within the upper third of the watershed (HRC property), such as accelerated sediment transport, poor wood recruitment, and impaired riparian function, reduce salmonid habitat quality throughout much of Bear River watershed. Industrial timber harvest impacts may be reduced under the HCP prescriptions, but several decades may pass before riparian and stream habitat recovers. The lower two-thirds of the watershed is privately owned and primarily used for grazing and ranching: appreciable timber harvest does not appear to occur outside of HRC land.

Roads and Railroads

High road density (greater than 3 miles of road per square mile of watershed) throughout the majority of the watershed is ranked as a High threat to adult, egg, and winter rearing juveniles, and a Very High threat to summer rearing juveniles. Roads accelerate sediment delivery to riparian and aquatic habitat, while also altering stream hydrography by accelerating storm runoff patterns. The majority of the roads in the watershed are associated with industrial timber land and managed under the HRC HCP; as required under their HCP, HRC is required to stormproof roads on their land to minimize erosional processes.

Livestock Farming and Ranching

Grazing in the middle and lower watershed represents a High threat to summer rearing steelhead. Poor livestock grazing practices can reduce the riparian corridor, increase upslope erosion, and facilitate nutrient loading of receiving waters through animal waste entering the stream channel. The extent to which current Bear River ranch owners have fenced cattle out of riparian areas is unknown, but analysis of aerial photos suggests little riparian fencing has occurred within the watershed.

Low or Moderate Ranked Threats

Fire is identified as a Medium threat because of its potential significance if a fire were to occur. No road-crossing barriers have been identified in the Bear River watershed, resulting in a Low threat ranking. Historically, small-scale gravel mining has occurred in the Bear River, and the Humboldt County Public Works is currently permitted to extract 3,000 $yards^3$ per year and 10,000 $yards^3$ per three to five year period from their Branstetter Bar sites (RM 1.5). Due to the low level of extraction, mining/gravel extraction is believed to be a Low threat to steelhead. Finally, there are no appropriative water rights in the Bear River watershed according to the NCRWQCB; however, the extent of riparian water rights is unknown. There are no dams in the watershed.

Limiting Stresses, Life Stages, and Habitats

The egg and juvenile lifestage is the most limiting to population viability within Bear River, given the high susceptibility to the effects of elevated fine sediment. Egg survival is likely low in areas exhibiting high fine sediment deposition; similarly, food availability and habitat complexity is likely compromised in these same areas, most affecting juvenile steelhead survival throughout the year. Poor riparian habitat function likely lowers water quality throughout much of the lower and middle mainstem river and within accessible tributaries.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Bear River steelhead population is discussed below with more detailed and site-specific recovery actions provided in the Implementation Schedule for this population.

Reduce Grazing and Road-related Erosion

Failing or improperly maintained roads are significant sources of fine sediment accumulation that is impairing Bear River habitat function. Many tributaries in the upper watershed have high fine sediment concentrations, and recent analysis suggests roads are the primary management-associated source of this type of sediment delivery (141 tons/mi2/yr) (HRC 2008). Although undocumented in the Bear River watershed, poor grazing management could be accelerating streambank erosion within the lower river where cattle grazing is most intensive.

Improve Instream LWD Volume

LWD volume is generally poor within most of the Bear River watershed, especially within the mainstem Bear River reach and the Brushy Creek sub-watershed. Intense historical timber harvesting (pre-1965) effectively depressed natural wood recruitment, while the devastating floods of 1955 and 1964 flushed much of the existing LWD out of the watershed (HRC 2008).

Improve Estuary Habitat

Restore the physical and biological attributes of the estuary. Improve juvenile steelhead rearing habitat by increasing the extent of the estuary and improving in-water structure and overwater cover.

Literature Cited

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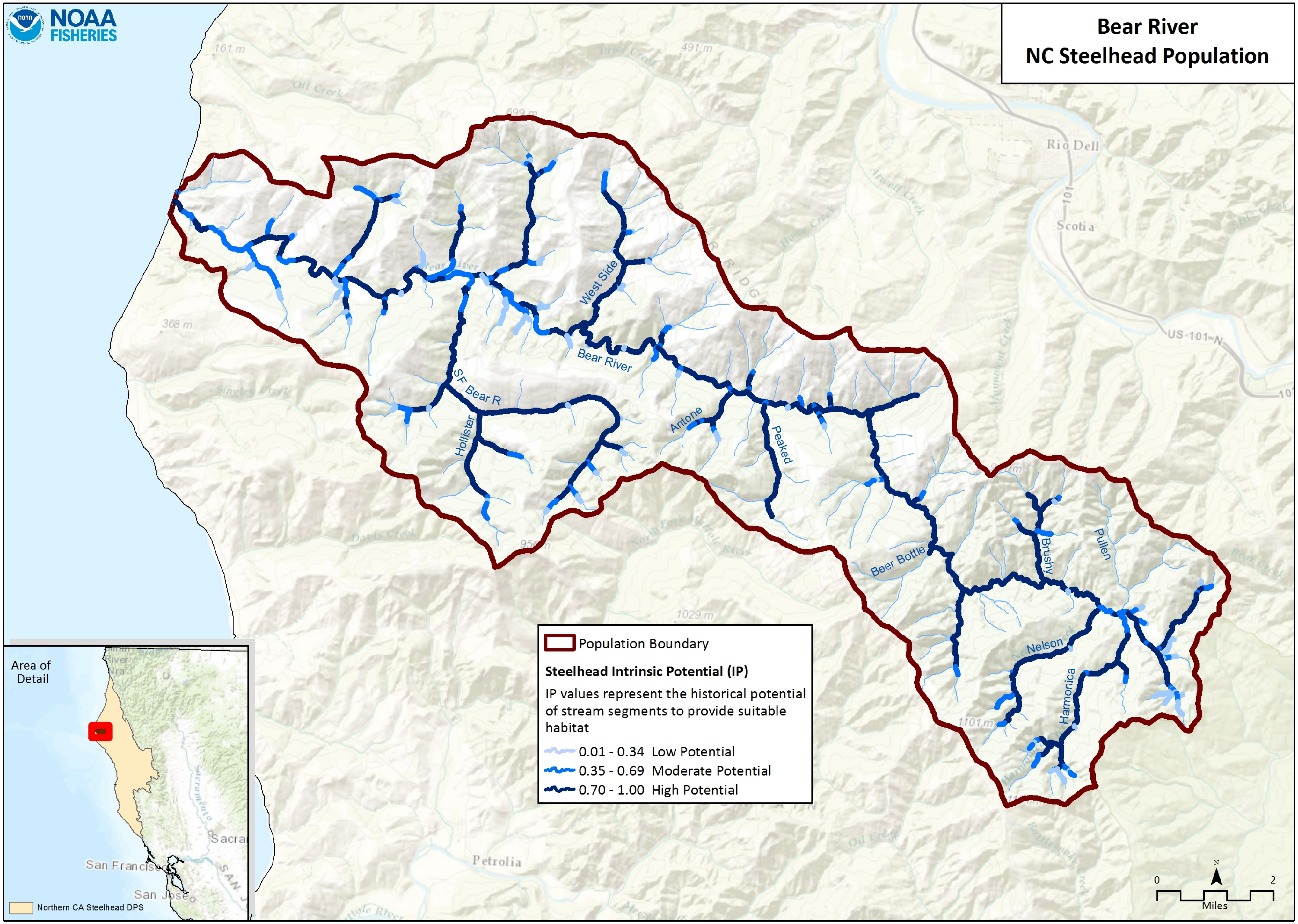
Bear River
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Bear River
West Side
SF Bear R
Hollister
Antone
Peaked
Beer Bottle
Brushy
Pullen
Nelson
Harmonica
Rio Dell
Scotia
Petrolia
US-101-N
161 m
491 m
368 m
1029 m
1101 m
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
0
2
Miles

NC Steelhead Bear River CAP Viability Results

	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35.05% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		low risk spawner density per Spence et al (2012)	Good
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	14.07% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% of pools are primary pools)	50% to 74% of streams/ IP-Km (>49% of pools are primary pools)	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)	>90% of streams/ IP-Km (>49% of pools are primary pools)	75% to 89% of streams/ IP-km (>49% of pools are primary pools)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	<50% of streams/ IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35.05% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	27.27 IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	100% of Historical Range	Very Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35.05% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.08% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	18.12% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	<25% Intact Historical Species Composition	Poor
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	4.73 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.79 Miles/Square Mile	Poor

NC Steelhead Bear River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Medium	Low	Medium	Low	Medium	Low	Medium
2	Channel Modification	Medium	Medium	Medium	Medium	Medium	Low	Medium
3	Disease, Predation and Competition	Medium	Low	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Low	Medium
5	Fishing and Collecting	Medium	Low	Medium	Low	Medium	Low	Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Medium	Medium	High	Medium	Medium	Medium	High
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Medium	High	High
9	Mining	Medium	Low	Medium	Low	Medium	Low	Medium
10	Recreational Areas and Activities	Medium	Low	Medium	Low	Medium	Low	Medium
11	Residential and Commercial Development	Medium	Low	Medium	Low	Medium	Low	Medium
12	Roads and Railroads	High	High	Very High	High	Medium	Medium	Very High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Low	Low	Medium	Low	Medium

Bear River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BearR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
BearR-NCSW-1.1.1.1	Action Step	Estuary	Study estuarine habitat suitability and utilization for rearing salmonids.	3	10	CDFW	
BearR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
BearR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess habitat and develop a plan to restore the historic floodplain through reconnection of sidechannels and offchannel habitat.	2	5	CDFW, NMFS	
BearR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Place instream structures, guided by assessment results.	2	10	CDFW, NMFS, NOAA RC, Private Landowners, RCD	
BearR-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
BearR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
BearR-NCSW-3.1.1.1	Action Step	Hydrology	Ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB	
BearR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
BearR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris to maintain current stream complexity, pool frequency, and depth.	2	50	Humboldt Redwood Company, Private Landowners	
BearR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency				
BearR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Assess habitat to determine beneficial locations and amount of instream structure needed.	3	10	CDFW, Humboldt Redwood Company, NMFS	
BearR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Place instream structures, guided by assessment results.	2	20	CDFW, Humboldt Redwood Company, NMFS	
BearR-NCSW-6.1.3	Recovery Action	Habitat Complexity	Improve shelter				
BearR-NCSW-6.1.3.1	Action Step	Habitat Complexity	Develop tributary pool and shelter projects with cooperative landowners to enhance presmolt and smolt survival	2	20	CDFW, NMFS, Private Landowners, RCD	
BearR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
BearR-NCSW-7.1.1.1	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	3	100	Humboldt Redwood Company	Focus on High IP subwatersheds.
BearR-NCSW-7.1.1.2	Action Step	Riparian	Plant native vegetation to promote streamside shade.	2	20	CDFW, Humboldt Redwood Company, NMFS, NOAA RC, Private Landowners, RCD	
BearR-NCSW-7.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
BearR-NCSW-7.2.1	Recovery Action	Riparian	Improve riparian conditions				
BearR-NCSW-7.2.1.1	Action Step	Riparian	Reduce detrimental environmental impacts of conversion of TPZ land to other uses.	2	10	NMFS, Calfire, BOF	
BearR-NCSW-7.2.1.2	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	10	NMFS, Calfire, BOF	
BearR-NCSW-7.2.1.3	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	10	Calfire, BOF	
BearR-NCSW-7.2.1.4	Action Step	Riparian	Work to ensure effects of activities on converted areas are minimized.	2	10	NMFS, Calfire, BOF	
BearR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				

Bear River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BearR-NCSW-8.1.1.1	Action Step	Sediment	Inventory sediment sources, and prioritize for treatment.	3	5	Humboldt Redwood Company, Private Landowners, RCD	
BearR-NCSW-8.1.1.2	Action Step	Sediment	Treat priority sediment source sites, guided by plan.	3	20	Humboldt Redwood Company, Private Landowners, RCD	
BearR-NCSW-11.1	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**				
BearR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
BearR-NCSW-11.1.1.1	Action Step	Viability	Conduct comprehensive monitoring to measure indicators for spawning and rearing habitat.	3	10	CDFW, NMFS	
BearR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**				
BearR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
BearR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Determine impacts of fisheries management on salmonids in terms of VSP parameters.	3	25	CDFW, NMFS	
BearR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	If actual fishing impacts exceed levels consistent with recovery, modify management so that levels are consistent with recovery.	3	5	CDFW, NMFS	
BearR-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Determine impacts of scientific collection on salmonids in terms of VSP parameters and determine if scientific collection authorizations exceed impacts consistent with recovery.	3	5	CDFW, NMFS	
BearR-NCSW-16.1.1.4	Action Step	Fishing/Collecting	Annually estimate the commercial and recreational fisheries bycatch and mortality rate for salmonids.	3	55	CDFW, NMFS	
BearR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BearR-NCSW-18.1.1.1	Action Step	Livestock	Assess grazing impact on sediment delivery and identify opportunities for improvement.	3	15	Private Landowners, RCD	Focus on High IP subwatersheds.
BearR-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
BearR-NCSW-18.1.2.1	Action Step	Livestock	Plant vegetation to stabilize streambank.	3	20	CDFW, NRCS, Private Landowners, RCD	
BearR-NCSW-18.1.2.2	Action Step	Livestock	Fence livestock out of riparian zones.	2	25	Private Landowners, RCD	
BearR-NCSW-18.1.3	Recovery Action	Livestock	Prevent or minimize impairment to water quality (e.g. turbidity, suspended sediment)				
BearR-NCSW-18.1.3.1	Action Step	Livestock	Remove instream livestock watering sources.	3	25	NRCS, Private Landowners, RCD	
BearR-NCSW-18.2	**Objective**	**Livestock**	**Address the inadequacy of existing regulatory mechanisms**				
BearR-NCSW-18.2.1	Recovery Action	Livestock	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
BearR-NCSW-18.2.1.1	Action Step	Livestock	Develop grazing management plan to reduce impacts of grazing on riparian and instream habitat.	3	10	CDFW, NMFS, NRCS, Private Landowners, RCD	Focus on High IP subwatersheds.
BearR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
BearR-NCSW-19.1.1.1	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	2	50	Humboldt Redwood Company	
BearR-NCSW-19.1.1.2	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	50	Humboldt Redwood Company	
BearR-NCSW-19.1.1.3	Action Step	Logging	Work with California BOF, CalFire, CDFW, professional organizations and landowners to protect forest lands from conversion, promote sustainable forestry practices and provide landowner incentives for growing late seral forests in riparian areas and conducting restoration actions.	2	25	Humboldt Redwood Company	
BearR-NCSW-19.1.1.4	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	3	50	Humboldt Redwood Company	
BearR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**				

Bear River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BearR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
BearR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to reduce delivery of sediment to streams.	3	5	Humboldt Redwood Company, Private Landowners, RCD	
BearR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	20	Humboldt Redwood Company, Private Landowners, RCD	
BearR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	15	Humboldt Redwood Company, Private Landowners, RCD	
BearR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	20	Humboldt Redwood Company, Private Landowners	
BearR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
BearR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
BearR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to salmonids.	3	10	Humboldt Redwood Company, Humboldt County, RCD	
BearR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species' continued existence**				
BearR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
BearR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Coordinate protection measures and develop rules for augmenting water supplies and mitigating the effects of drought on salmonids.	3	20	Humboldt Redwood Company, Private Landowners	
BearR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Design habitat restoration projects to account for long-term changes including sea level rise, flooding frequency and loss of sediment, by increasing resiliency of existing habitat types and facilitating upstream passage (California State Coastal Conservancy et al. 2010).	3	50	Humboldt Redwood Company, NRCS, Private Landowners, RCD	
BearR-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BearR-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BearR-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Identify alternative water sources, storage means, or seasonal withdrawal restrictions to increase streamflow during low flow periods.	2	20	Private Landowners, RCD	
BearR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Provide education and training on conserving water while diverting.	2	20	Private Landowners, RCD	
BearR-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Provide incentives to landowners to reduce water consumption during low flow periods.	2	20	Private Landowners, RCD	

Humboldt Bay Tributaries Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 4,100 adults
- Current Intrinsic Potential: 203.4 IP-km

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The Humboldt Bay watershed drains approximately 433 square kilometers, with a majority of this occurring in the major spawning tributaries of Jacoby Creek, Freshwater Creek, Salmon Creek, and Elk River. Because population data collection in the Humboldt Bay watershed is limited, abundance of the steelhead population is inferred from the trends observed in Freshwater Creek.

In Freshwater Creek, the number of adult steelhead returns shows no statistically significant trend from 2000 through 2014 (Ricker and Anderson 2014). Return estimates have ranged from a high of 432 adults in 2003-2004 to a low of 51 adults in 2008-2009 (Ricker and Anderson 2014). The adult steelhead escapement in Freshwater Creek over the three most recent years was estimated to be 108 ± 35 (95% C.I.) in 2011-12, 149 ± 60 (95% C.I.) in 2012-2013, and 127 ± 54 (955 C.I) in 2013-2014 (Moore *et al.* 2012). Spatial distribution of juvenile steelhead in Humboldt Bay tributaries is less than the historic extent; however, recent habitat restoration monitoring in the lower portions of tributaries (e.g., Wood Creek; Salmon Creek; Jacoby Creek) has revealed they will distribute to new habitat when made available.

History of Land Use

Vegetation in the upper watershed of the Humboldt Bay Tributaries population area was historically coniferous forest, dominated by coast redwood. Douglas-fir and tanoak occur in association with redwood, and other forest trees include grand fir, Sitka spruce, western red cedar, western hemlock, and red alder in riparian areas. Historic riparian canopy cover was likely high, and large wood was abundant in streams. Sediment delivery, storage, and transport processes within the streams were a function of the geology, climate, and channel morphology (Doughty 2003). Prior to the 1800s, the historic salmon habitat in the population area was largely unaffected by anthropogenic land use. After 1800, European settlement, land use, and resource extraction influenced landscape processes, which resulted in decreased quality, quantity, and accessibility of habitat for salmon adult spawning and juvenile rearing (Beechie *et al.* 2003).

Harvest of old growth trees began in the 1860s with concomitant building of railroads linking the forests to the mills on the Humboldt Bay waterfront. Timber harvest practices that degraded aquatic habitat included: (1) clear cuts that altered the hydrology and increased sediment delivery to the watercourse; (2) loss of riparian floodplain to harvest and road construction; (3) use of tributary stream channels as haul roads; (4) steam donkey dragging of logs within stream channels; and (5) use of larger stream channels for log transport and splash-dams. Several periods of timber harvest have occurred in the Humboldt Bay watershed; initially harvesting the easily accessible timber from 1860 to 1910, and then subsequent harvesting higher in the watershed. In the 1800s, a common road building practice for road-stream crossings was a "Humboldt" log crossing, where organic debris was pushed into the stream and buried with soil. The use of Humboldt crossings, instead of culverts or bridges, continued into the 1970s and created a persistent source of sediment delivery to watercourses (HBWAC 2005).

Current Resources and Land Management

Numerous community-based organizations are engaged in salmonid, watershed, and ecosystem restoration activities, which are distributed across public, private and tribal lands in the Humboldt Bay watershed. The local history of restoration, existing patterns of land ownership and settlement, the presence and engagement of numerous Federal and state public lands management agencies as well as regulatory agencies, and the robust civic culture and community relationships is vital for recovery of Humboldt Bay salmonid populations (Baker and Quinn-Davidson 2011).

Humboldt Bay is an important commercial and recreational shellfish growing area, as well as deep-water port. Land ownership within the coastal zone, which includes the tidelands and submerged lands of Humboldt Bay to mean higher high water (MHHW) and surrounding lands from MHHW inland to the California Coastal Zone Boundary, is both private and public. Management of the submerged lands and historic tidelands in Humboldt Bay is primarily the responsibility of the Humboldt Bay Harbor, Recreation, and Conservation District (HBHRCD). The HBHRCD was established in 1970 to manage Humboldt Bay for the promotion of commerce, navigation, fisheries, recreation, the protection of natural resources, and to acquire, construct, maintain, operate, develop, and regulate harbor activities. In addition to the HBHRCD, numerous districts, city, county, state and Federal entities have ownership and regulatory jurisdiction over land use activities in the coastal zone (HBHRCD 2007).

Currently in the upper tributary watersheds of Humboldt Bay, the dominant land use is timber production and harvest. The majority of land in the upper Humboldt Bay watershed is privately owned by two commercial timber companies, Humboldt Redwood Company (Freshwater Creek, Elk River, and Salmon Creek) and Green Diamond Resource Company (Jacoby Creek, Elk River, Salmon Creek). Approximately 24 square miles (15,400 acres), or 77% of the Freshwater Creek watershed, is owned and managed for timber by Humboldt Redwood Company (Domoni Glass Watershed Professionals Network 2003). The dominant land use in the middle and lower portions of the Humboldt Bay watershed are agriculture, urban, residential, and industrial development. Agricultural land is used primarily for livestock grazing and hay production. Urban, residential, and industrial land use are concentrated in the city of Arcata (population 16,651), the city of Eureka (population 26,128), and in five smaller communities near Humboldt Bay, with a total population of approximately 70,000 (HBWAC 2005). There is currently more residential development in the Jacoby Creek and Freshwater Creek watersheds than in the Elk River or Salmon Creek watersheds.

Outside of incorporated municipalities, there is limited public ownership of land within the Humboldt Bay watershed. The few exceptions are as follows. The City of Arcata owns and manages a 2,100 acre community forest which includes a demonstration forest in the Jacoby Creek watershed. The California Department of Fish and Wildlife (CDFW) manages five wildlife areas (Mad River Slough 587 acres; Fay Slough 484 acres; Elk River 2,131 acres; and South Spit 598 acres). The U.S. Fish and Wildlife Service manages the approximately 4,000 acres of the Humboldt Bay National Wildlife Refuge, with holdings in both the north and south bay areas. Humboldt County manages a small park which includes a seasonal impoundment and associated fish ladder in Freshwater Creek. The Headwaters Forest Reserve, public land managed jointly by the Bureau of Land management and CDFW, includes nearly 7,500 acres of redwood and Douglas-fir forests and protects stream systems that provide habitat for steelhead in South Fork Elk River and Salmon Creek.

Numerous water quality, land use, resource management, and habitat conservation related planning documents specific to Humboldt Bay and its watershed have been prepared (see list below). Local community land use plans (Arcata, Eureka, and Humboldt County) provide direction for future growth and development, express community values and goals, and portray the community's vision of the future. These plans contain measures (*e.g.,* zoning ordinances) designed to protect aquatic habitat by controlling watershed erosion and by maintaining instream flows and enhancing riparian habitat. These plans strive to integrate the incorporated and unincorporated areas within the Humboldt Bay watershed.

- U.S. Bureau of Land Management and California Department of Fish and Game, Headwaters Forest Reserve Resource Management Plan (USBLM and CDFG 2004);
- U.S Fish and Wildlife Service Humboldt Bay National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2009);
- Humboldt Bay Harbor, Recreation and Conservation District Humboldt Bay Management Plan (HBHRCD 2007);
- Humboldt County General Plan Update (ongoing);
- City of Eureka General Land Use Plan (City of Eureka 1997); and
- City of Arcata General Plan 2020 (City of Arcata 2008).

Aside from Federal land management agency and HBHRCD plans, numerous regulatory mechanisms are designed to protect aquatic habitat in the Humboldt Bay watershed. The National Marine Fisheries Service has issued long-term (50-year) section 10(a)(1)(B) Incidental Take Permits for the activities and associated habitat conservation plans for two commercial timber companies in the Humboldt Bay watersheds. Within the State of California, the California Department of Forestry and Fire Protection, the State Board of Forestry and Fire Protection, and the California Environmental Protection Agency have regulatory mechanisms in place or in development to reduce sediment impairment to aquatic habitat from land-based activities in the Humboldt Bay watershed. The North Coast Regional Water Quality Control Board (Regional Water Board) and the U.S. Environmental Protection Agency (EPA) have listed the Freshwater Creek watershed and Elk River watershed under the Clean Water Act Section 303(d) as sediment impaired waterbodies. A program has been developed to recover waterbodies listed under Clean Water Act Section 303(d) via the establishment of Total Maximum Daily Loads (TMDL). The Regional Water Board staff is in the process of establishing TMDLs for sediment in the Freshwater Creek and Elk River watersheds. The goal of the TMDL program is to restore and maintain the sediment impaired beneficial uses of water of Freshwater Creek and Elk River and their tributaries. Regulatory mechanisms affecting private lands in the Humboldt Bay watershed include:

- Humboldt Redwood Company Habitat Conservation Plan (HRC 2012);
- Green Diamond Resource Company Habitat Conservation Plan (GDRC 2006);
- California Department of Forestry and Fire Protection and California Department of Fish and Game Anadromous Salmonid Protection Rules (CDFFP and CDFG 2010);
- North Coast Integrated Regional Water Management Plan (NCRP 2007); and
- California State Water Resources Control Board and California Environmental Protection Agency. Water Quality Control Plan for Enclosed Bays and Estuaries. Part 1. Sediment Quality (CSWRCB and CEPA 2009).

Local stakeholders have been proactive in both developing salmonid conservation and habitat restoration plans, strategically coordinating funding and implementation of projects and taking an ecosystem approach to potential effects of sea level rise and climate change:

- Humboldt Bay Watershed Salmon and Steelhead Conservation Plan (HBWAC 2005);
- North Coast Anadromous Salmonid Conservation Assessment (Tussing and Wingo-Tussing 2005);
- Humboldt Bay Ecosystem-Based Management Program (HBHRCD 2007);
- Humboldt Bay Initiative: Adaptive Management in a Changing World (Schlosser *et al.* 2009);
- California Pacific Coast Joint Venture Coastal Northern California Component Strategic Plan (CPCJV 2004); and
- The Humboldt Bay and Eel River Estuary Benthic Habitat Project (Schlosser and Eicher 2012).

Many completed restoration projects have leveraged opportunities on public lands, as well as provided incentives for participation by private landowners. For example, the City of Arcata Baylands and McDaniel Slough Restoration and Enhancement Projects restored and enhanced wetland, riparian and stream habitat adjacent to the Humboldt Bay National Wildlife Refuge, the Arcata Marsh and Wildlife Sanctuary, the Mad River Slough Wildlife Area and Jacoby Creek Land Trust holdings, thereby establishing a continuous, protected habitat area of over 1,300 acres. The Humboldt Bay Initiative (Schlosser *et al.* 2009) identified the need for: (1) a non-profit Coastal Ecosystem Institute of Northern California (CEINC), now established; and (2) a proactive, coordinated response to shoreline and hydrologic changes, and the resulting shifts in land use, human communities, species and habitats due to climate change. In 2013, the CEINC along with the HBHRCD, convened an Adaptation Planning Working Group to begin preparation of a sea level rise adaptation plan for Humboldt Bay.

Salmonid Viability and Watershed Conditions

The following indicators are rated "Poor" for this NC steelhead population: numbers of spawners, water quality (turbidity), hydrology (redd scour), gravel quality, and habitat complexity (large wood frequency, percent primary pools). Landscape-level land use (timber harvest, urbanization, and road density) has affected watershed hydrology and sediment transport.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Humboldt Bay CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Viability: Density, Abundance, and Spatial Structure

Relative to historic numbers and recovery targets, the numbers of spawning adults are low in the Humboldt Bay population leading to an overall rating of Fair. Low numbers of juveniles and reduced density of summer-rearing juvenile steelhead suggest that the watershed is not functioning properly. The current spatial distribution of juvenile steelhead is believed to be less than 50 percent of historic distribution. Expression of known diverse life history outmigration and rearing strategies of juvenile salmonids are limited by the quantity and quality of both freshwater and estuarine habitat.

Landscape Patterns: Agriculture, Timber Harvest and Urbanization

The Landscape Patterns conditions have an overall rating of Fair. Clearing of vegetation has increased surface runoff, and over-harvest of riparian vegetation has caused a consequent decrease in both the downed large wood and the amount of future potential large wood. Relative to hydrologic function, reduction in large woody debris decreases in-channel sediment storage, reduces channel roughness, and reduces the ability of the stream to attenuate peak flows. Inboard ditches collect and channelize surface runoff and subsurface flows, then efficiently route sediment and other pollutants present in the water to streams, resulting in higher, earlier, and more frequent peak flows. Increased peak flow may increase the frequency of channel bed mobilization, increasing the probability of redd scour and disturbance of alevins in redds, as well as displacing over-wintering juveniles.

Altered Sediment Transport: Road Condition and Density

Sediment Transport from road conditions have an overall rating of Poor for watershed processes. The Humboldt Bay watersheds are comprised of moderately unstable geologic composition. There were very large stressing storms in the late 1990s following a high level of logging operations. These storms, combined with poor landing and stream crossing locations and poor road construction practices caused sediment problems. Specifically, large storms between 1993 and 1997 routed stored sediment from lower order tributary watersheds down to the low gradient storage reaches and caused significant amounts of landsliding associated with old roads and landings, transporting considerable volumes of sediment downstream.

Increased sediment delivery has filled pools, widened channels, and simplified stream habitat throughout the Humboldt Bay watershed, including the tidally influenced habitats and the estuary.

Habitat Complexity: Large Wood and Shelter

Habitat Complexity: large wood and shelter has a Poor rating for winter rearing juveniles. Large woody debris originating from adjacent riparian forests is a form of cover in many streams, and its importance within pools is widely recognized (Bisson *et al.* 1987; Holtby 1988). Large riparian trees that fall into streams and rivers contribute to a range of habitat types. In particular, large diameter conifer trees support a variety of habitats through their unique ability to enhance channel scouring, improve velocity heterogeneity, and trap coarse sediments. Habitat diversity is essential to steelhead growth and survival because scour pools provide cover from predators and a high flow refugia during winter. In addition, the substrate and velocity enhancements improve spawning and rearing habitat quality.

Habitat Complexity: Percent Primary Pools and Pool/Riffle Ratios/Flatwater Ratios

Habitat Complexity; percent primary pools and pool/riffle ratios/flatwater ratio have an overall Fair rating for winter rearing juveniles. Jacoby Creek, Freshwater Creek, and Elk River have been listed by the North Coast Regional Water Quality Control Board (NCRWQCB) and the U.S. Environmental Protection Agency (USEPA) as sediment impaired under the Clean Water Act Section 303(d). Excessive fine sediment can result in poor spawning habitat for adults, suffocate eggs, reduce velocity refugia for winter rearing juveniles, and reduce the productivity of food organisms for winter- and summer-rearing juveniles. Accelerated delivery of sediment to Humboldt Bay tributaries from roads and historic timber harvest activities have resulted in aggraded channels and shallow pools. This lack of complex overwintering habitat throughout much of the system may be a major factor in the population decline of Chinook salmon.

Velocity Refuge: Floodplain Connectivity

Velocity Refuge has a rating of Fair for winter rearing juveniles. The primary indicator for this habitat attribute is availability and abundance of velocity refuge during high flows. Velocity refugia are provided by physical features (*e.g*., pools, large wood) discussed previously, as well as access to and quality of floodplain habitat. Lack of backwater pools along the freshwater channel margins reduces overwintering refugia from high flows

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian Vegetation has a rating of Poor for summer rearing juveniles. Clearing of riparian forests is one factor that alters recruitment of large woody debris to streams (another being harvest of unstable or potentially unstable slopes), subsequently altering sediment transport and storage, deposition and storage of sediment, bed roughness, interaction between the channel and floodplain, channel habitat characteristics including pool habitat (spacing, area, and depth) both in freshwater and tidally influenced habitats. Riparian vegetation also provides: (1) shade, which influences water temperature; (2) nutrients and organic material (leaves, insects); and (3) bank stabilization. The composition of the prey community is a factor in habitat use, for example, a study conducted in the Freshwater Creek watershed in 2004 (Cummins *et al.* 2005) found that greater numbers of juvenile salmon were present where the system was heterotrophic, relying on riparian inputs of energy.

Water Quality: Turbidity or Toxicity

The condition of turbidity has a Poor rating for adults and winter-rearing juveniles. Increased suspension of sediments, and resultant increased turbidity, can cause avoidance responses, and physical damage to gills of juveniles, smolts and adults, as well as reduced feeding and growth rates of juveniles and smolts. High levels of fine sediment and embeddedness can also reduce the feeding success, and ultimately growth of 0+ and 1+ fish, because extended periods of high turbidity reduce visibility of prey as well as the type of invertebrate prey available. Epibenthic grazer and predator taxa of benthic macroinvertebrates, an important food source for salmonids, are limited or non-existent in channels with high levels of sedimentation. Nutrient loading from septic tank overflow, runoff from grazing lands, and reduced riparian vegetation, contribute to impaired water quality.

Estuary: Impaired Quality and Extent

The condition of the Estuary is rated Fair for juveniles and smolts. Juvenile steelhead use estuarine habitat for rearing, as a transitional habitat between the freshwater and marine environments, and as velocity refugia. Juvenile steelhead primarily use the upper portion of the stream-estuary ecotone (tidal freshwater, and low gradient streams) year-round and smolts typically rear and emigrate during the winter and early spring. Wallace and Allen (2015) reported 80-90% of large steelhead smolts in 2007-2008 originated from the stream-estuary ecotone habitat in Freshwater Creek. The structure and function of the tidally influenced habitat in the drowned river mouths around Humboldt Bay, as well as in the contiguous nearshore and deeper channel habitats in Humboldt Bay have been significantly altered from natural conditions. The quality of rearing habitat for juveniles and smolts has been reduced as a result. The physical and biological habitat-forming processes, the light regime, and the spatial extent of the intertidal and subtidal habitats in Humboldt Bay have been directly altered as a result of: (1) upland land use activities that increase sediment transport, reduce floodplain/tidal marsh storage of sediment, and limit large wood recruitment and delivery to the tidally influenced habitats; (2) agricultural practices that diked, drained and eliminated estuarine rearing habitat; (3) construction of roads and railroads that effectively act as dikes, altering hydrology and habit accessibility; (4) port and harbor development and interrelated commercial and recreational activities; and (5) urbanization and development of Arcata and Eureka.

Maintenance dredging of the Federal Navigation Channels and jetty construction to stabilize the mouth of Humboldt Bay changed the volume of flood and ebb-tidal shoals, modified the tidal prism, and forced a new equilibrium state (Larson *et al*. 2002). Since 1950, from March through May, juvenile salmonids present in Humboldt Bay may be exposed to the annual dredging. Overflow of the hopper dredge during annual maintenance dredging of the Federal Navigation Channels, results in water quality that has: (1) been degraded due to increased turbidity; (2) reduced the localized availability of the water column habitat for rearing and migration of juvenile salmonids during each daylight dredge cycle; and (3) disoriented fish entrained in the prop wake and turbidity plume, and in turn increased the likelihood of predation by birds during the day.

Over-water structures (piers, piles, docks, and moored boats) in Humboldt Bay, along with associated shading and localized hydraulic effects, cause detrimental effects to salmonid habitat. These structures: (1) reduce the amount of nearshore intertidal and subtidal eelgrass habitat, (2) reduce the connectivity of nearshore habitat, (3) alter the type of cover and prey available for juvenile salmonids, and (4) trigger salmonid behavioral habitat avoidance. Because salmonids avoid swimming under over-water structures, individuals will occupy the middle to the surface of the water column in deeper water adjacent to structures, as opposed to occupying more shallow water as they would in the absence of the structures (Toft *et al.* 2004). As a result of fragmentation of nearshore habitat, including eelgrass habitat, juvenile salmonids likely increase the amount of time traveling between eelgrass patches, which: (1) results in decreased foraging; and (2) increases their exposure to predators where eelgrass cover is reduced or over-water structures are present.

Alteration and loss of salt marsh, intertidal and subtidal habitat in Humboldt Bay adjacent to the Eureka watershed resulted from the construction of the three State Highway 255 Humboldt Bay bridges in 1971 and Woodley Island Marina in 1981. Hardening of the shoreline has reduced the extent of the intertidal habitat, restricted sediment transport, and likely increased nearshore turbulence. Artificial illumination in the nearshore during otherwise normal periods of darkness can provide enough light for visual feeders to see and capture prey (Yurk and Trites 2000; DeVries *et al.* 2003; Longcore and Rich 2004). Harbor seals prey on juvenile salmonids in water at least 2 m deep, and feed actively in the light-shadow boundary produced by halogen bridge lights and residual city lighting (Yurk and Trites 2000).

Sediment: Gravel Quality and Distribution of Spawning Gravels

The condition of Sediment has a Poor rating for winter-run adults, eggs, summer- and winter-rearing juveniles. Gravel quality for eggs is rated poor because much of it is too small, resulting in potential reduced survival due to impaired conditions. Embedded channel gravels reduce permeability of redds, which reduces the amount of oxygen available to steelhead eggs, thereby potentially reducing growth and survival of eggs. Further, the success of steelhead fry emergence from spawning gravels decreases as channel embeddedness increases. Sediments delivered to the streams and creeks are, over time, transported to tidally influenced habitats in the lower portions of the tributaries and ultimately into Humboldt Bay, as discussed in the subsequent section on impaired function of tidally influenced habitat.

Habitat Complexity: Large Wood and Shelter

The condition of Habitat Complexity: large wood and shelter has an overall Fair rating for adults, summer rearing juveniles and smolts. See earlier discussion.

Floodplain Connectivity: Impaired Quality and Extent

This condition has a Fair rating for adults and winter rearing juveniles. The primary indicator for this habitat attribute is availability and abundance of velocity refuge during high flows. Velocity refugia are provided by physical features (*e.g.*, pools, large wood) discussed previously, as well as access to and quality of floodplain. Levees and dikes limit connectivity between mainstem slough channels and potential floodplain habitat in valley floor and stream-estuary ecotone sections of most Humboldt Bay tributaries. Tide gates in dikes block fish passage into formerly accessible estuarine rearing habitat and spawning tributaries in the Humboldt Bay watershed (USFWS 2007).

Hydrology: Redd Scour Events and Watershed Characterization: Impervious Surfaces

This condition has an overall Poor rating for watershed processes. Although approximately 2.97% of the watershed consists of impervious surfaces, this rating does not recognize the high density of impervious surfaces within the lower floodplain in Eureka and Arcata. Urbanization within these areas has led to increased surface runoff and higher peak flows, both of which negatively affect hydrology and fish habitat. These high peak flows led to a Poor rating for eggs due to redd scour.

Water Quality: Temperature

Water Quality has a rating of Fair for summer-rearing juveniles and smolts. High summer water temperatures, in combination with low dissolved oxygen, in lower Salmon Creek, lower Freshwater Creek, and in the lower Elk River slough limit habitat function for rearing (Wallace

2007; Wallace and Allen 2007). Nutrient loading from septic tank overflow, runoff from grazing lands, and reduced riparian vegetation, contribute to impaired water quality.

Passage/Migration: Mouth or Confluence and Physical Barriers

Passage/Migration conditions have a rating of Fair for winter-run adults, summer-rearing juveniles, winter-rearing juveniles, and smolts. In the tidally-influenced lower region of the watershed, passage barriers (e.g., culverts, tide gates) have limited the accessibility to juvenile and adult salmonids, thereby reducing the quantity and quality of the tidal freshwater and estuarine rearing habitat for anadromous salmonids. Prior to 1988, access to Humboldt Bay tributaries was very limited due to migration barriers. Since the early 2000s, several fish passage projects have been completed using a variety of techniques to enhance and restore fish access.

Hydrology: Baseflow and Passage Flows

Hydrology, baseflow and passage flows have an overall rating of Fair for eggs, summer-rearing juveniles, smolts, and adults.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Humboldt Bay CAP results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Humboldt Bay CAP results.

Roads and Railroads

Forest roads are a primary causative factor for both altered sediment supply and altered hydrologic function. The density of roads in the Humboldt Bay watershed is generally high (>3 miles of roads per square mile). Pacific Watershed Associates (2006) reported that between 1989 and 2003 there were 76 miles of road constructed in Freshwater Creek (30.7 mi^2), which resulted in an overall road density of 7.6 mi/mi^2. They also reported that Ryan Slough and Fay Slough, both tributaries to Freshwater Creek, have road densities of 8.7 mi/mi^2, and 8.8 mi/mi^2, respectively. Roads and road ditches extend the stream channel network, concentrate hillslope runoff and capture subsurface flows, often resulting in changes to the natural hydrograph. Specifically, historic peak flows are exceeded due to the increase in road-stream connectivity and peak flows occur more frequently. Further, inboard ditches effectively convey road-related sediment to streams. In some watersheds, road erosion may annually contribute more sediment to the stream system than mass wasting (PWA 2006).

Channel Modification

This threat rates High for juveniles, smolts, and watershed processes. The extent of channelization and diking in the lower portion of Humboldt Bay watersheds, as well as the Reclamation District Levee in North Bay and associated tide gates, limits the availability of tidal freshwater and estuarine rearing habitats.

Livestock Farming and Ranching

Livestock farming and ranching is a High threat to summer rearing juveniles. Grazing and haying occurs throughout the lower watersheds and likely contributes to increased sediment mobilization and delivery. Cattle grazing and instream watering contribute to degraded riparian and aquatic habitat, primarily in the lower watershed, and reduce its function for rearing. Production of prey is also limited by increased turbidity and nutrient loading from feces. Diking of tidelands and installation of tidegates to create land for agriculture has eliminated the majority of the intertidal rearing habitat around Humboldt Bay.

Low or Moderate Rated Threats

Logging and Wood Harvesting

This threat rates as Medium for adults, summer and winter rearing juveniles, smolts and watershed processes. This threat rates Low for eggs. See previous discussion under Landscape Patterns.

Residential and Commercial Development

Overall, this threat rates as Medium. The Humboldt Bay Management Plan (HBHRCD 2007) identified the primary use of Humboldt Bay as port-related activities, in the area below the Samoa Bridge to South Bay (which serves as a salmon migratory corridor and rearing habitat). Further, future development may degrade existing tidally influenced habitat and limit the efficacy of existing or planned restoration projects. Discharge of treated wastewater to Humboldt Bay is permitted from treatment plants for the City of Arcata, greater Eureka, and College of the Redwoods (NCRWQCB 2005), and the volume of discharge would increase with fully realized potential of the land zoned for residential development.

Disease, Predation and Competition

Non-native species pose a Medium threat to juveniles and smolts both in freshwater and in tidally influenced habitat in the tributary watersheds, as well as in Humboldt Bay. Capture of six Sacramento pikeminnow, a salmonid predator currently present in the Eel River, in Martin Slough in 2008 prompted CDFW to survey other tributaries within the Elk River watershed, and to begin a targeted eradication program. One additional pikeminnow was captured in Martin

Slough in May 2010. Monitoring of this pikeminnow revealed it was capable of migrating through the lower portions of the watershed and was tolerant to brackish water.

Because Humboldt Bay is used as a port, numerous, non-native invertebrate species, which often appear as fouling organisms on piers and pilings, have been introduced in ballast water or from vessel hulls (Boyd *et al.* 2002). Culture of the non-native oyster, *Crassostrea japonica*, also introduced a number of non-native invertebrate species into Humboldt Bay. The non-native dwarf eelgrass (Z*ostera japonica*) and denseflower cordgrass (*Spartina densiflora*), are present, and were also likely introduced in ballast water and as deposited ballast, respectively. Monitoring of non-native invertebrates and intertidal and salt marsh vegetation in Humboldt Bay, as well as eradication programs, are ongoing.

Water Diversion and Impoundments

Diversions pose a Medium threat to juveniles, smolts and adults. There are no large dams in the Humboldt Bay watershed. The Union Water Company constructed a small dam on Jolly Giant Creek in 1930. The 50-foot high structure, located above the zone of anadromy, within the Arcata Community Forest, is no longer used as a water impoundment. The structure lacks a spillway and is drained by an undersized cast iron pipe. A large amount of sediment is stored in the old reservoir bed and sediment mobilizes downstream when the drainpipe is unclogged and head exists, following frequent plugging.

From the 1920s through 2001, a flashboard dam was installed on Freshwater Creek at Freshwater Park from June through September to create a swimming area. Prior to 2002, this summer dam was a barrier to potential upstream and downstream movement of juvenile salmonids. In order to enable fish passage, the County of Humboldt, owner and operator of Freshwater Park, worked with fisheries biologists and engineers (private, academic, State, and Federal) in 2001 to design, and build: (1) a temporary dam bypass structure (operated 2002-2007); and (2) a permanent concrete fish ladder, embedded in the streambank. Neither the dam, nor the temporary bypass, were installed in 2008. Juvenile salmonids currently utilize the permanent fish ladder, and have been observed moving upstream and downstream of the flashboard dam (HCDPW 2010; 2011).

According to the Department of Water Resources data base (http://www.waterboards.ca.gov/ewrims/), there are 53 appropriative water rights and diversion points in the Eureka Plain, but they are not all active. However, not all water diversions are registered with DWR. Riparian residential and agricultural uses can comprise significant amounts of water especially during low flow periods. Although water users may be required to obtain a lake or streambed alteration agreement from CDFW, this has not been common practice for small agriculture and residential withdrawals. Due to channel aggradation and subsequent limited instream water storage, water withdrawals in the summer months can reduce both the fluvial and tidal freshwater habitat available for rearing salmon. Consequently, the combination of reduced natural flow and anthropogenic withdrawals further reduces water quality (*i.e.*, lowered dissolved oxygen) in the remaining habitat.

Mining, Hatcheries and Aquaculture, Fishing and Collecting, Recreational Areas and Activities

Mining occurs in few locations and at small scales in the Humboldt Bay watershed, no hatcheries exist in the watershed and straying from the nearby Mad River Hatchery is rare, fishing and collecting activities occur at low levels, and recreation has little overlap with steelhead habitat. Potential effects to steelhead from aquaculture exist (e.g., food-web dynamics, eelgrass habitat degradation) and therefore warrant further study. The overall rating of these threats is Low.

Limiting Stresses, Lifestages, and Habitats

The summer rearing juvenile lifestage is most limiting, primarily due to altered sediment supply, lack of floodplain and channel structure, and impaired estuary. The combined effect of excess sediment filling pools along with the lack of structure to regulate sediment transport or induce scour, significantly reduces the complexity of the instream habitat. Furthermore, steelhead historically depended on the rich stream-estuary ecotone, and the loss of those areas has further limited rearing opportunities.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Humboldt Bay Tributaries steelhead population is discussed below with more detailed and site-specific recovery actions provided in Humboldt Bay CAP results, which provides the Implementation Schedule for these populations.

Recovery actions to reduce the stresses of the Humboldt Bay Tributaries steelhead population should focus on restoring the natural watershed processes (*i.e.*, the fluvial transport of wood, water, sediment, nutrients, and energy) within Jacoby Creek, Freshwater Creek, Salmon Creek and Elk River. Improved quality and quantity of habitat, as well as increased accessibility of seasonally important rearing habitats (backwater freshwater habitats, and tidally influenced wetland habitats in spring, summer, and fall) in all of the tributaries to Humboldt Bay will allow for increased growth and survival of individuals. Because many designated land uses in the population area have not yet been realized (*e.g.*, land not yet developed, timber not yet harvested), the opportunity for protection of habitat through innovative incentive programs, alternative land use scenarios, and partnerships provides a means to reduce the stresses and help restore natural landscape processes. Increasing abundance of steelhead, as well as increasing the potential for expression of diverse life history strategies through increased diversity of spatially and temporally available spawning and rearing habitats, should enhance the resilience and increase the likelihood of viability of these populations. Because the potential for non-native vegetation to establish in estuarine restoration sites is high due to the disturbance of the substrate and proximity of existing seed sources, estuarine restoration projects should employ measures to enhance colonization by native species.

Population monitoring, as well as implementation of recovery actions in the Elk River watershed, are especially important for recovery.

Improve Estuary Habitat
Restore the physical and biological attributes of the estuary, including the stream-estuary ecotone. Improve rearing habitat by increasing in-water structure and overwater cover, restoring access to the tidal slough habitats, and creation of off-channel velocity refugia for winter rearing.

Improve Floodplain Connectivity
Prevent further loss of riparian vegetation and rehabilitate riparian areas that are currently in poor condition. As discussed below the recovery of riparian function will improve LWD recruitment, but also is expected to increase prey availability through terrestrial insect subsidies. Create off-channel freshwater rearing habitat.

Improve Instream Habitat Complexity
Improve large woody frequency across the Humboldt Bay watershed. Riparian areas are in the process of recovery with stands of smaller diameter conifers that currently buffer stream areas. Addition of large wood will provide much needed stream channel complexity until riparian areas reach maturity and begin to recruit large wood naturally to channels. Large wood will improve instream habitat attributes (*e.g.*, pool and riffle frequency, habitat complexity) provide refuge from high flows; and provide for increased growth and survival of juveniles during winter and summer. Information from existing plans and assessments should be utilized in determining high priority streams for large wood restoration projects.

Improve Instream Habitat and Substrate Quality
Continue efforts to reduce sediment delivery from past management caused sources of roads, timber harvest, grazing, and agriculture. Funding must be continued for the implementation of the remaining road and other sediment reduction projects.

Improve Water Quality

Continue efforts to improve water quality by reducing erosion of streambanks from livestock grazing, and off-road vehicle recreational activities.

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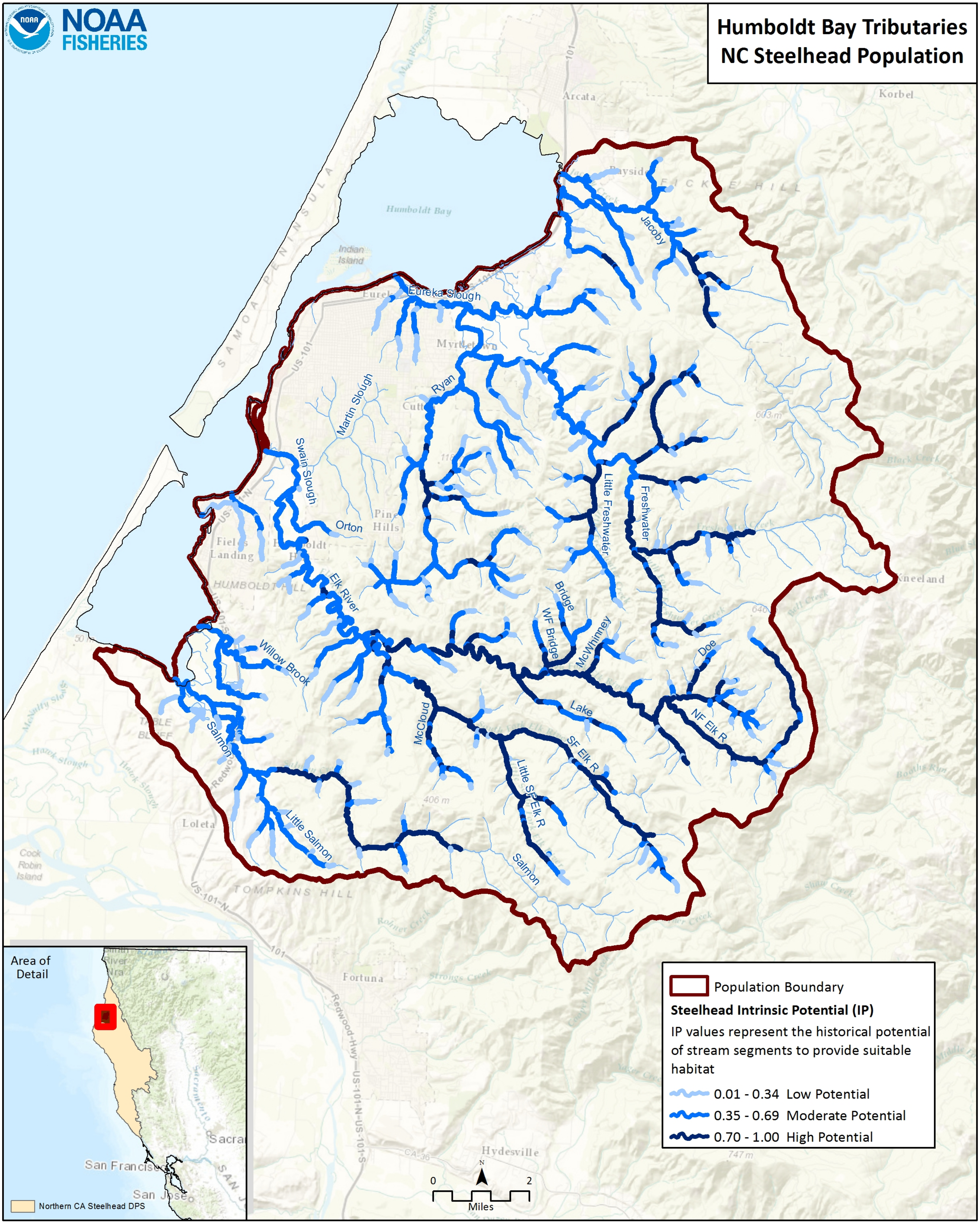
NOAA FISHERIES
Humboldt Bay Tributaries
NC Steelhead Population
Arcata
Korbel
Humboldt Bay
Indian Island
Eureka Slough
Jacoby
Myrtletown
Ryan
Martin Slough
Swain Slough
Orton
Pine Hills
Fields Landing
HUMBOLDT HILL
Elk River
Little Freshwater
Freshwater
Bridge
WF Bridge
McWhinney
Doe
Willow Brook
Salmon
McCloud
Lake
NF Elk R
SF Elk R
Little SF Elk R
Little Salmon
Salmon
TABLE BLUFF
Loleta
TOMPKINS HILL
Kneeland
Fortuna
Hydesville
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
2
Miles

NC Steelhead Humboldt Bay CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	53% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	55% of streams/ IP-km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.31	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	87.95 of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	54.56% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	41	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	76.67	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.71	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		1.44 Spawners per IP-km = >1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	26.63	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	41	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	36% of streams/ IP-km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	53% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	55% of streams/ IP-km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.31	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	Fair

					Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35	Factor Score 51-75	
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	51 Diversions/10 IP-km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	87.95 of IP-km	Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	98% of streams/ IP-km (>70% average stream canopy)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	54.56% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	41	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	76.67	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.71	Fair

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	98.93% IP km (<20 C MWMT)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	53% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.31	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	87.95 of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	54.56% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	41	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	76.67	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.71	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	55% of streams/ IP-km (>80 stream average)	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	51 Diversions/10 IP-km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	76.67	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.71	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		28,300-570,000 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	8% of Watershed in Impervious Surfaces	Fair
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	6.25% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	55.51% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	22% of watershed >1 unit/20 acres	Poor
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	12.59 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	10.43 Miles/Square Mile	Poor

NC Steelhead Humboldt Bay CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Medium	Low		Low		Low	Low
2	Channel Modification	Medium	Medium	Medium	Medium	Medium	High	High
3	Disease, Predation and Competition			Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression			Medium	Low	Medium		Medium
5	Fishing and Collecting	Medium						Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Medium	Medium	High	High	High	Medium	High
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Medium	Medium	Medium
9	Mining							
10	Recreational Areas and Activities	Low		Medium	Low	Low		Low
11	Residential and Commercial Development	Medium	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Low	High	High	Medium	High	High
13	Severe Weather Patterns	Medium	Low	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium

Humboldt Bay Tributaries, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
HumbB-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
HumbB-NCSW-1.1.1.1	Action Step	Estuary	Increase extent and quality of stream-estuary ecotone habitat through restoration	2	25	CDFW, NGO	
HumbB-NCSW-1.1.1.2	Action Step	Estuary	Increase connectivity and salmonid access to watersheds entering Humboldt Bay.	2	25	CDFW, NGO	
HumbB-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
HumbB-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Develop plan to create off-channel ponds, alcoves, and backwater habitat.	1	10	NGO	
HumbB-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Create habitat guided by plan.	1	20	NGO	
HumbB-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
HumbB-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
HumbB-NCSW-3.1.1.1	Action Step	Hydrology	Ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB	
HumbB-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
HumbB-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	10	CDFW	
HumbB-NCSW-6.1.1.2	Action Step	Habitat Complexity	Increase LWD, boulders, or other instream structure, guided by assessment.	2	10	NGO	
HumbB-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**				
HumbB-NCSW-6.2.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
HumbB-NCSW-6.2.1.1	Action Step	Habitat Complexity	Reduce removal of instream large wood (i.e., wood poaching)	2	10	NPS, CDFW, County	
HumbB-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
HumbB-NCSW-7.1.1.1	Action Step	Riparian	Plant native riparian species in open areas	2	10	NGO	
HumbB-NCSW-7.1.1.2	Action Step	Riparian	Remove non-native species that inhibit establishment of native riparian vegetation	2	10	NGO	
HumbB-NCSW-7.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
HumbB-NCSW-7.2.1	Recovery Action	Riparian	Improve canopy cover				
HumbB-NCSW-7.2.1.1	Action Step	Riparian	Reduce detrimental environmental impacts of conversion of TPZ land to other uses.	2	10	NMFS, Calfire, BOF	
HumbB-NCSW-7.2.1.2	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	10	NMFS, Calfire, BOF	
HumbB-NCSW-7.2.1.3	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	10	Calfire, BOF	
HumbB-NCSW-7.2.1.4	Action Step	Riparian	Work to ensure effects of activities on converted areas are minimized.	2	10	NMFS, Calfire, BOF	
HumbB-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-8.1.1	Recovery Action	Sediment	Improve gravel quantity and distribution for macro-invertebrate productivity (food)				

Humboldt Bay Tributaries, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
HumbB-NCSW-8.1.1.1	Action Step	Sediment	Develop study to analyze the frequency and effect of gravel scouring events. If deemed needed implement measures to minimize redd scour.	2	10	NGO	
HumbB-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
HumbB-NCSW-18.1.1.1	Action Step	Livestock	Assess grazing impact on riparian condition, identifying opportunities for improvement.	3	15	NRCS, RCD	
HumbB-NCSW-18.1.1.2	Action Step	Livestock	Develop grazing management plan to reduce impacts of grazing on riparian and instream habitat.	3	10	NRCS, RCD	
HumbB-NCSW-18.1.1.3	Action Step	Livestock	Fence livestock out of riparian zones.	2	20	Private Landowners	
HumbB-NCSW-18.1.1.4	Action Step	Livestock	Plant vegetation to stabilize stream bank.	3	20	NGO	
HumbB-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
HumbB-NCSW-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription to improve size and density of conifers	2	50	NGO	
HumbB-NCSW-19.1.1.2	Action Step	Logging	Plant conifers as guided by prescription	2	25	NGO	
HumbB-NCSW-19.1.1.3	Action Step	Logging	Thin, or release conifers guided by prescription	2	20	Private Landowners	
HumbB-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
HumbB-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
HumbB-NCSW-19.2.1.1	Action Step	Logging	Amend California Forest Practice Rules to include regulations which describe the specific analysis, protective measures, and procedure required by timber owners and CalFire to demonstrate timber operations described in timber harvest plans meet the requirements.	3	10	CalFire	
HumbB-NCSW-19.2.1.2	Action Step	Logging	Apply BMPs for timber harvest.	3	50	Private Landowners	
HumbB-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HumbB-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
HumbB-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream hydrologic connection, and identify appropriate treatment	2	20	NGO	
HumbB-NCSW-23.1.1.2	Action Step	Roads/Railroads	Assess road network for roads that are currently unnecessary for silvicultural operations.	2	20	NGO	
HumbB-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission roads, guided by assessment	2	10	NGO	
HumbB-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment	3	25	Private	
HumbB-NCSW-23.1.1.5	Action Step	Roads/Railroads	Upgrade roads, guided by assessment	2	20	Private	

Little River Population

NC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 1,800 adults
- Current Intrinsic Potential: 50.0 IP-km

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Since 1998, outmigrant trapping, summer juvenile, and adult spawning surveys have been conducted throughout the watershed on an annual basis and currently provide the best indication of fish abundance and distribution (GDRC 2009; 2010; 2011). Habitat sampling occurs approximately every eight years (GDRC 2006). Habitat and outmigration monitoring data is available from the early 1990s for inferring longer term trends (Vogel 1992; Shaw and Jackson 1994; Vogel 1994). Little River watershed fishery potential was determined in the late 1960s to evaluate potential effects of a proposed dam in the upper watershed, which ultimately was never completed (Hurt 1969).

In the late 1960s, the Little River spawning steelhead population was estimated to be approximately 625 individuals (Hurt 1969). Shaw and Jackson (1994) captured 1,113 steelhead smolts from a single screw trap and documented outmigration to be between March and May, peaking in late April. Juvenile steelhead population estimates from select tributaries to Little River between 1998 and 2010 ranged from 222 to 719 individuals (GDRC 2009). Figure 1 shows outmigrant NC steelhead smolt estimates between 1999 and 2012 from select Little River tributaries. In 2013, 1,309 outmigrant 1+ steelhead were captured in select Little River tributaries (same tributaries as Figure 1). In 2014, 1,077 outmigrant 1+ steelhead were captured in select Little River tributaries. In 2015, 6,055 outmigrant 1+ steelhead were captured in select Little River tributaries, although during this year outmigrant trapping ceased at Railroad Creek, but began at a station in mainstem Little River. In addition, in 2015, Green Diamond Resource Company observed 1,058 1+ steelhead during their summer dive counts of selected tributaries of Little River (GDRC 2016). In addition, 1,152 0+ and 34 1+ steelhead were captured through electroshocking (GDRC 2016).

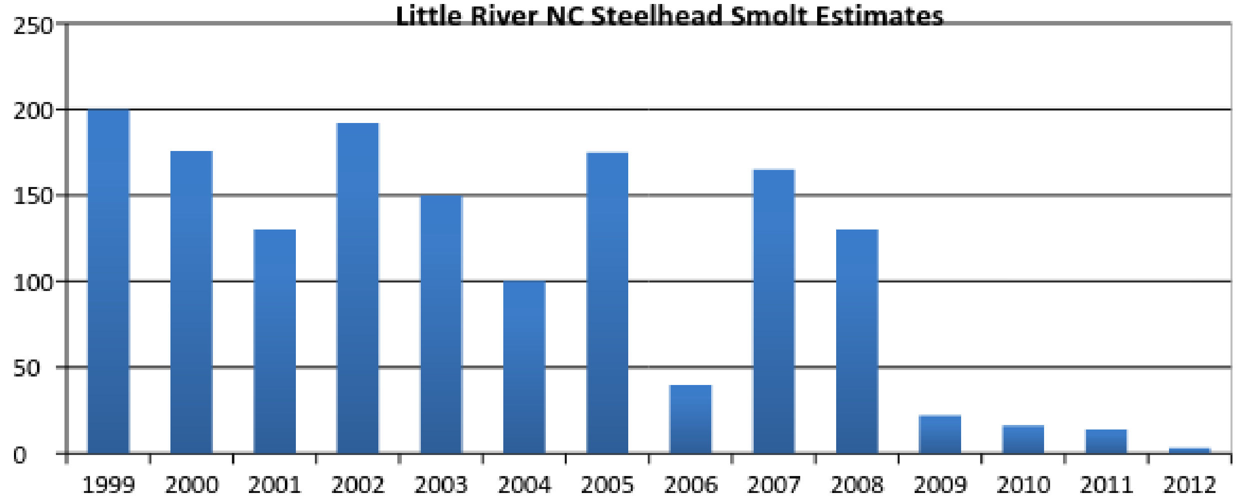

Figure 1. Out-migrant NC steelhead population estimates from select Little River tributaries, 1999-2012 (GDRC 2009; 2011).

History of Land Use

Timber harvest, commercial fishing, and livestock grazing all historically occurred in the Little River basin. The first sawmill opened on the Little River in 1907 by the Hammond Lumber Company (Hurt 1969) and the basin was intensely harvested throughout the early 1900s. The logging town of Crannell was built on the coastal plain near the Little River mouth. The river was modified for logging operations, with the main channel flowing through a lumber mill. Logging trucks and roads replaced railroad logging after a fire burned the majority of the watershed in 1945 (Hurt 1969). Large-scale clear cuts, road construction, skid trails, and landings occurred on highly erodible Franciscan soils that are dominant throughout the basin. Highly erosive geology in combination with extensive timber harvest and road building over the years has led to mass wasting events, landslides, and chronic sediment delivery into Little River. Trees were cut in the riparian zone, removing the potential for instream wood recruitment and increasing solar radiation. In the 1930s, a dam was constructed just above the town of Crannell and a commercial fishery for Chinook salmon was established, which largely destroyed the population (Hurt 1969). Dairy cow operations have been conducted on the Little River floodplain between Crannell and the river mouth. Some stream restoration work has taken place; in 1989, the lower 2.5 kms of Little River were fenced to prevent cows from entering the riparian.

Current Resource and Land Management

Today, the majority of the basin is owned by Green Diamond Resource Company (GDRC), and managed for timber production under the guidelines of current state timber harvest regulations and an aquatic habitat conservation plan (HCP, GDRC 2006). Management under the HCP helps protect the watershed from many of the destructive practices that took place historically. An extensive road system (at a density of approximately 7 mi./sq. mi.) winds through the basin, contributing sediment delivery to Little River and tributaries. The flat coastal plain near the mouth of the Little River continues to support livestock grazing. While some of the riparian areas have been fenced to prevent livestock from disturbing them, areas that are not fenced may experience degradation of sensitive vegetation and contribute to bank instability and erosion.

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for Little River steelhead population: smolt abundance, spawner density, gravel quality (embeddedness), road density, streamside road density, timber harvest, turbidity, large wood frequency, and V* (amount of fine sediment in pools) (see Little River CAP results).

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Little River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Large woody debris associated with riparian corridors provides structure for shade, cover, bank stabilization, and breeding sites for invertebrates (Mosley *et al.* 1998). The condition of Habitat Complexity: large wood and shelter have a Poor rating for winter rearing juveniles and smolt stages. Large wood debris increases habitat complexity by creating pools, velocity refuge, and cover. Large wood debris surveys conducted throughout the watershed in the 1990s revealed that large wood debris throughout Little River is on average less than 4 pieces/100 m (Vogel 1992). Green Diamond completed large wood surveys for the Little River Basin in 2005; survey results show that South Fork Little River and Railroad Creek have the highest volume of large wood, while the mainstem Little River has the lowest volume (GDRC 2009). Current practices under the GDRC HCP provide a riparian buffer, and promote recruitment of LWD by allowing 99 percent of riparian conifers to be older than 60 years, and 70 percent older than 80 years.

Viability: Density, Abundance, and Spatial Structure

Reduced density, abundance, and diversity has a Poor rating for steelhead winter adults and smolts. Since 1999, steelhead smolt abundance has decreased by an order of magnitude (GDRC 2012). Reduced juvenile and smolt density, abundance, and diversity may signify decreased adaptions to environmental stochastic events such as marine survival and spawning success. Populations that remain low in abundance have an increased likelihood of becoming extirpated.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Imapired gravel quality and quantity is a High stress for steelhead eggs and winter rearing juveniles. Salmonid egg survival is inversely related to fine sediment, which has the potential to suffocate eggs (Koski 1966; Greig *et al.* 2005). A streambed substrate survey revealed that fine sediment concentrations are greatest in Lower South Fork Little River, ranging from 7.5- 15.7 percent of sampled sediment particles (Vogel 1994). Increased sediment delivery is primarily a result of high road density and timber harvest activities in Little River. Embedded gravels prevent winter rearing juvenile steelhead for seeking velocity refuge during high winter flows. Embedded gravels also reduce stream productivity, and thus decrease foraging success for summer-rearing juvenile steelhead.

Estuary: Quality and Extent

Estuaries provide important juvenile rearing areas for steelhead and Chinook salmon, often fostering faster growth than upper watershed areas due to a high abundance of prey items (Hayes *et al.* 2008). The lower estuary remains unaltered, currently comprising approximately 0.75 river miles of mud flat, wetland, and sandbar habitat in Moonstone Beach County Park and Little River State Park. Upstream of Highway 101, the estuary and many associated tidal channels have been diked, filled, and channelized for agricultural purposes. Estuarine function is severely hampered by loss of tidal wetland and tidal channels. The reduction in estuarine function is considered a highly stressful for the smolt lifestage because of the lack of rearing and foraging habitat.

Water Quality: Turbidity or Toxicity

Clean and cool well-oxygenated water remains one of the most important ecological requirements for salmonids. Water quality conditions in the Little River have a rating of Poor for smolts. High road density, riparian vegetation reduction, livestock grazing, and components of timber management contribute to increased turbidity levels. Effects of increased sediment and turbidity loads range from lethal to sublethal (Newcombe and MacDonald 1991), with early life history phases being most sensitive (Sigler *et al.* 1984). Salmonids rely on visual feeding cues, and increased turbidity may reduce visibility and thus feeding efficiency (Berg and Northcote 1985; Sweka and Kartman 2001).

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian vegetation provides important habitat functions including shading, habitat complexity for foraging and holding, and channel function. Eliminating or decreasing riparian vegetation may result in stream channelizing and straightening, channel widening, channel aggradation, and lowering of the water table (Belsky *et al.* 1999). The condition, Riparian Species Composition and Structure have a rating of Fair for summer rearing juveniles and watershed processes. Historic logging practices removed the majority of large, old trees from riparian zones throughout watershed; shrubs and both young and mature deciduous and conifers dominate the upper watershed and dense shrubs such as willow and blackberry occupy the lower watershed (Vogel 1992; GDRC 2006). Livestock grazing has removed components of riparian vegetation; historic timber management reduced canopy cover structure and diversity. The reduction of large trees in riparian areas results in decreased potential for large wood recruitment, which consequently reduces habitat complexity.

Sediment Transport: Road Density

The condition of Sediment Transport: road density has a rating of Poor for all life history stages, especially early life history phases that are more sensitive to elevated turbidity levels. Little River contains a high density of roads in silvicultural areas (an average of 7.1 miles of road per square mile of land). Processes initiated or affected by roads include landslides, surface erosion, secondary surface erosion, and gullying. Existing road networks are a chronic source of sediment to streams (Swanson and Dryness 1975) and often are the main cause of accelerated surface erosion in forests across the western United States (Harr and Nichols 1993). Important factors that affect road surface erosion include road surface condition, use during wet periods, location relative to watercourses, and steepness.

Very Good or Good Rated Current Conditions

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Complex pools provide rearing habitat for juvenile Chinook salmon. Reduced pool complexity results in decreased vegetative cover and prey availability, and thus slower juvenile growth rates. Historical logging resulted in large sediment input into Little River, resulting in sediment filling pools. Lack of complex pools, and also fewer deep pools, creates flatwater habitats (neither pool nor riffle), which drastically reduced pool complexity. Summaries from habitat typing data collected by Green Diamond in 2005 indicate that, currently, 84% of the sites surveyed in Little River had over 30% pools and over 20% riffles (GDRC 2009). These same summaries also indicate that 96% of the kilometers surveyed had over 30% pools and over 20% riffles (GDRC 2009).

Velocity Refuge: Floodplain Connectivity

Floodplain connectivity in the Little River was rated Good for adult and winter-rearing steelhead based on an overall estimated >80% response reach connectivity. Juvenile salmonid prey availability remains higher in side channels than the main river channel, with a carrying capacity as much as 260 percent higher (Bellmore *et al.* 2013). The floodplain in the lower Little River has been decreased by channel modification, historic timber operations, and the construction of levees for agricultural purposes. All life history phases are affected by decreased availability of floodplain habitat. Consequently, steelhead in the lower Little River may be subject to areas of lower food availability and thus slower growth rates.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Little River CAP results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Little River CAP results.

Logging and Wood Harvesting

Logging and wood harvesting was rated as a High stress for eggs, summer rearing juveniles, winter rearing juveniles, smolt, and watershed processes. Historic logging practices in Little River resulted in large-scale clear cuts, road construction, skid trails, and landings on highly erodible soils. Highly erosive geology, in combination with extensive timber harvest has led to mass wasting events, deep-seated landslides, and chronic sediment delivery into Little River. During the years of intense harvest, the river likely had high turbidity that severely affected development and behavior of all fish species. Decreased habitat complexity, channel aggregation and decreased water quality are all results of intensive silvicultural practices. Management practices have significantly changed, and it is expected that practices such as riparian buffers and sediment management will improve habitat conditions and population abundance.

Agricultural Practices

Next to timber harvest, agriculture is the predominant land use in the lower Little River basin and represents a high threat, especially for sub-adult life stages. The land is used for grazing livestock, hay operations, and also a minor amount of cranberry bogs. There is little to no livestock exclusion from the river and animals often trample streambanks and overgraze the riparian vegetation. The grazing of livestock adjacent to the stream leads to eroded banks and an excess of sediment and nutrients entering the water. In addition, diversions and ditches associated with agriculture in the area contribute to degraded habitat conditions and poor hydrologic connectivity. The reduction of estuarine function in the Little River is primarily the result of conversion of lowland estuarine habitat to agricultural land and the agricultural practices that occur in the estuarine floodplain.

Roads and Railroads

Roads and railroads were rated as a High stress for steelhead winter adults, eggs, winter rearing juveniles, smolts, and watershed processes. As described earlier, Little River contains a high density of roads in silvicultural areas. Processes initiated or affected by roads include landslides, surface erosion, secondary surface erosion (landslide scars exposed to rain splash), and gullying. Existing road networks are a chronic source of sediment to streams (Swanson and Dyrness 1975) and often are the main cause of accelerated surface erosion in forests across the western United States (Harr and Nichols 1993). Elevated turbidity levels may results in decreased growth rates of juveniles, reduced survival of eggs, and reduced feeding success due to turbid conditions. GDRC has begun the process of hydrologically disconnecting roads from the Little River watershed.

Channel Modification

Channel modification was rated as a High stress for smolts. The lower Little River mainstem has been channelized by dikes and levees for agricultural and livestock purposes. The function of the upper estuary (*e.g.*, rearing, refugia, and ocean transition) has been degraded, and juveniles and smolts rearing in or transitioning through mainstem and estuarine habitat will continue to be threatened by the lack of intertidal brackish and salt marsh. Both juveniles and smolts suffer from the lost opportunity for increased growth, which would improve their size at time of ocean entry and marine survival.

Severe Weather Patterns

Severe weather patterns related to climate change such as increased temperature, reduced cold-water refugia, and increased incidences of atmospheric river events are currently rated as Medium to all life history phases. Severe weather combined with a landscape of fragile soils, high road density, and timber operations may cause significant amounts of fine sediment input to the Little River. Decommissioning roads and ensuring that adequate stream buffers are in place may offset the deleterious effects of severe weather.

Limiting Stresses, Lifestages, and Habitat

The current condition and threat analyses suggest that physical habitat for adult as well as summer and winter rearing juveniles is most limiting, and includes habitat complexity, water quality, and sediment. Timber harvest and high road density are the primary threats to steelhead. Historic timber harvest activities reduced large wood abundance and riparian vegetation complexity, consequently reducing habitat complexity. Runoff from the high density roads increase turbidity levels and contribute to decreased water quality, streambed aggradation.

Channel modification creates a High threat for steelhead smolts. The unavailability of complex estuarine rearing and foraging habitat subjects smolts to reduced growth, and thus potentially decreased marine survival and size at maturity.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating current conditions and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Little River populations is discussed below with more detailed and site-specific recovery actions provided in Little River CAP results, which provides the Implementation Schedule for this population.

Estuarine Restoration

The estuary provides critical rearing habitat for juvenile steelhead and Chinook salmon. A management plan should be developed for the Little River estuary to restore tidal salt and brackish marshes in order to allow fish to have access to high quality foraging and rearing habitat. Riparian areas currently being used for livestock grazing should be fenced in order to allow native vegetation to recover and become reestablished. Riparian buffer areas should be established to create space for the reestablishment of tidal marshes. Dikes and levees should be removed or set back to restore natural habitat-forming processes. Tidegates should be inventoried and removed in order to create tidal fluctuation. The recreation of complex tidal channels may be necessary east of Highway 101 in areas where the main channel has been straightened and simplified.

Road Decommissioning

Little River contains a high density of dirt logging roads. Sediment loading from these roads contributes to poor salmonid habitat conditions including elevated turbidity levels, stream aggradation, and impaired gravel quality. Existing road-stream connections should be assessed and upgraded or decommissioned to the maximum extent practical.

Increase In-stream and Off-channel Complexity

Little River currently lacks habitat complexity in many areas due to reduced large woody debris, channel aggradation, invasive species, and altered riparian vegetation. Large wood, boulders, or other instream structure should be added in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be re-created. Riparian areas should be revegetated.

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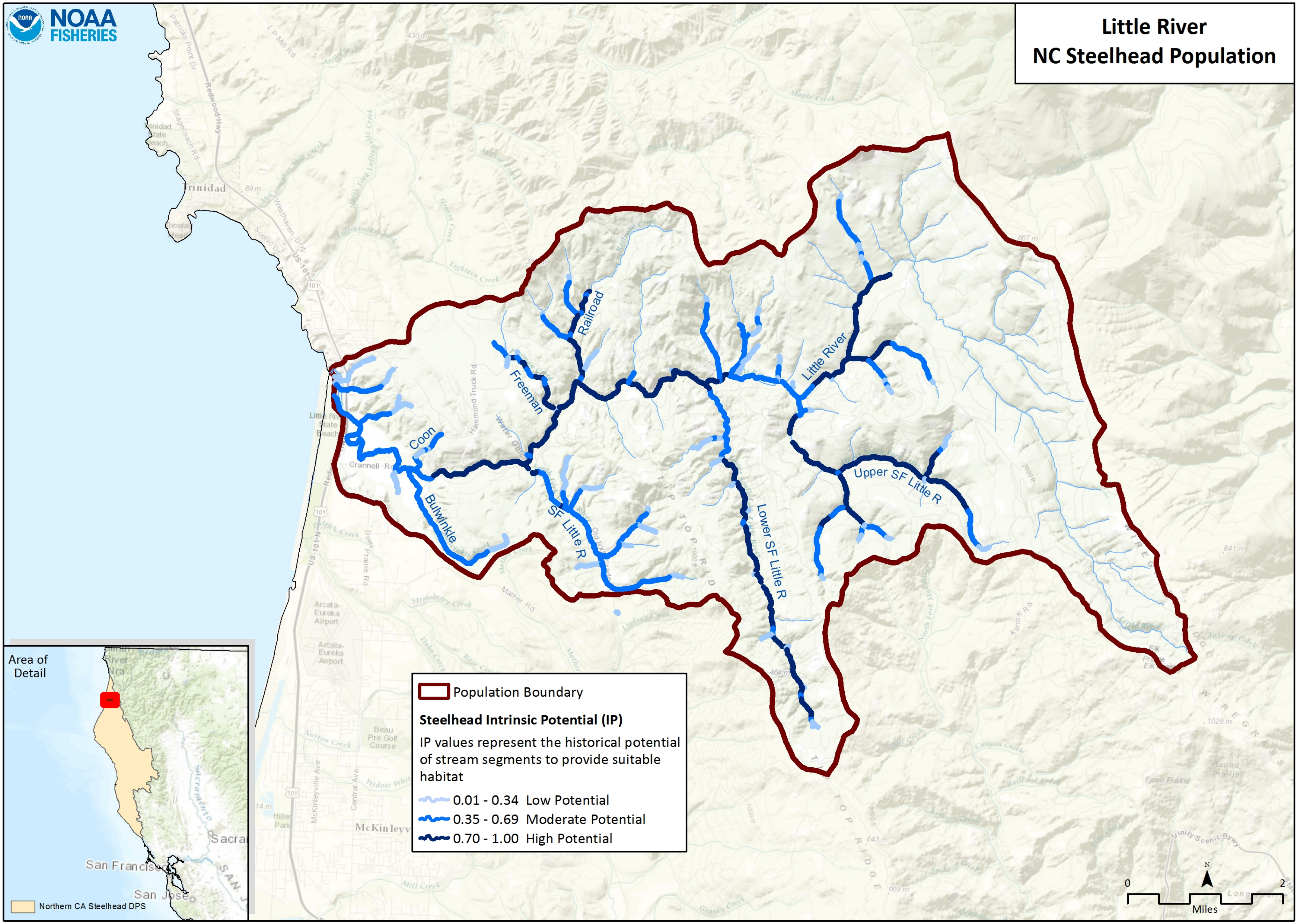

Little River
NC Steelhead Population
NOAA FISHERIES
Railroad
Freeman
Coon
Bulwinkle
SF Little R
Lower SF Little R
Little River
Upper SF Little R
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
Miles
0
2

NC Steelhead Little River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	55% of streams/ IP-km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.46	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 26	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	79% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	43% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	47	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	40-60	Fair
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 26	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 26	Very Good

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	47	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	50% of streams/ IP-Km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	60% of streams/ IP-km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.46	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 38	Good

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 38	Good
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.4 Diversions/10 IP-km	Good
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	79% of IP-km	Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	85% of streams/ IP-Km (>70% average stream canopy)	Good
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	43% Class 5 & 6 across IP-km	Fair
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	47	Fair
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	40-60	Fair
Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	100% IP-km (<20 C MWMT)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	67% of Historical Range	Fair
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.46	Poor

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	79% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	43% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	47	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	40-60	Fair
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	55% of streams/ IP-km (>80 stream average)	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.4 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 26	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	95% IP-km (>6 and <14 C)	Very Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	40-60	Fair
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		<6300 = Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.0251% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	91% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	7% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	7.62 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	7.67 Miles/Square Mile	Poor

NC Steelhead Little River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Medium	Medium
2	Channel Modification	Low	Medium	Medium	Medium	High	Medium	Medium
3	Disease, Predation and Competition	Low		Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	Medium						Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Medium	Medium
8	Logging and Wood Harvesting	Medium	High	High	High	High	High	High
9	Mining							
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	High	High	Medium	High	High	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium

Little River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LTRNC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LTRNC-NCSW-1.1.1	Recovery Action	Estuary	Increase extent of estuarine habitat				
LTRNC-NCSW-1.1.1.1	Action Step	Estuary	Assess tidally influenced habitat and develop plan to restore tidal channels.	2	1	CDFW, Coastal Conservancy, NMFS	
LTRNC-NCSW-1.1.1.2	Action Step	Estuary	Restore tidal wetlands and tidal channels, guided by plan.	2	5	CDFW	Cost estimate taken from SONCC coho salmon recovery plan, $420,000
LTRNC-NCSW-1.1.1.3	Action Step	Estuary	Assess and prioritize tidegates and levees for removal or replacement.	2	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-1.1.1.4	Action Step	Estuary	Remove or replace tidegates and levees, guided by assessment.	2	5	CDFW	Cost estimate taken from SONCC coho salmon recovery plan, $357,360
LTRNC-NCSW-1.1.1.5	Action Step	Estuary	Initiate a study to determine if the Highway 101 bridge crossing the Little River is constricting the river channel and impeding river or tidal circulation in the estuary.	2	1	CDFW	
LTRNC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LTRNC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)				
LTRNC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop plan to restore habitat complexity by recreating areas of low water velocity.	2	1	CDFW, Coastal Conservancy, NMFS	
LTRNC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Restore habitat complexity in identified areas by implementing actions to increase the frequency of pool habitats.	2	10	CDFW	
LTRNC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency				
LTRNC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Develop plan to add large wood, boulders, or other instream structure to specific areas in specific quantities.	2	1	CDFW, Coastal Conservancy, NMFS	
LTRNC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Place instream structures, guided by assessment.	2	5	CDFW	
LTRNC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LTRNC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
LTRNC-NCSW-7.1.1.1	Action Step	Riparian	Plant native riparian species in denuded areas.	2	2	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-7.1.1.2	Action Step	Riparian	Remove invasive species that inhibit establishment of native riparian vegetation.	3	5	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-7.1.2	Recovery Action	Riparian	Prevent or minimize adverse alterations to riparian species composition and structure				
LTRNC-NCSW-7.1.2.1	Action Step	Riparian	Manage riparian forests to promote late-seral characteristics while maintaining bank stability and existing shade.	3	1	CDFW, CalFire, NMFS, Private Landowners	
LTRNC-NCSW-7.1.2.2	Action Step	Riparian	Plant conifers in denuded areas, guided by prescription.	2	2	CDFW, CalFire, NMFS, Private Landowners	
LTRNC-NCSW-7.1.2.3	Action Step	Riparian	Thin, or release conifers, guided by prescription.	3	5	CDFW, CalFire, NMFS, Private Landowners	
LTRNC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LTRNC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality to reduce embeddedness				
LTRNC-NCSW-8.1.1.1	Action Step	Sediment	Assess existing riparian buffers to ensure that the buffers are capturing the majority of fine sediments before entering watershed.	3	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-8.1.1.2	Action Step	Sediment	Identify areas that are currently not functioning as sediment traps.	3	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-8.1.1.3	Action Step	Sediment	Plant riparian species to augment riparian vegetation.	3	3	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-8.1.1.4	Action Step	Sediment	Assess potentially large inputs of fine sediments (e.g., landslides, failed culvert).	3	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-8.1.1.5	Action Step	Sediment	Develop plan to remove large inputs of fine sediments.	3	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-8.1.1.6	Action Step	Sediment	Remove large inputs of fine sediments.	3	10	CDFW, Coastal Conservancy, NMFS, Private Landowners	

Little River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LTRNC-NCSW-8.1.1.7	Action Step	Sediment	Restore locations that are currently or imminently large producers of fine sediments.	2	10	CDFW, Coastal Conservancy, NMFS, Private Landowners	
LTRNC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LTRNC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
LTRNC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess streamside roads and prioritize decommissioning to minimize mass wasting.	2	1	CDFW, CalFire, NMFS, Private Landowners	
LTRNC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Develop plan to decommission or maintain roads with mass wasting potential.	2	1	CDFW, CalFire, NMFS, Private Landowners	
LTRNC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission or upgrade roads with mass wasting potential throughout watershed.	2	20	CDFW, CalFire, NMFS, Private Landowners	

Mad River Population (Lower and Upper)

NC Steelhead Winter-Run

Lower Mad River

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 3,200 adults
- Current Intrinsic Potential: 145.7 km

Upper Mad River

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 5,800 adults
- Current Intrinsic Potential: 289.6 IP- km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal/North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: NA

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

There are no known systematic adult or juvenile population surveys for NC steelhead on the Mad River. Steelhead snorkel surveys were conducted sporadically until about 2008, but the level of effort varied within and between years, making statistical inferences impossible. CDFW operated a fish ladder from 1938 through 1964 at Sweasey Dam (built in 1938 and removed in 1970), producing the only known reliable population time series for steelhead in the Mad River.

Steelhead have been documented in all fishbearing tributaries up to migration barriers (Stillwater Sciences 2010). A major barrier to migration exists near Deer Creek (rkm 84.8), which restricts passage during all but the highest flows. However, some adult steelhead are found in Pilot Creek (rkm 92.8; Stillwater Sciences 2010) and as far upstream as Mathews Dam.

The largest steelhead return to Sweasey Dam was 6,650 steelhead in 1942, with the population declining significantly to approximately 2,000 by the 1960s. For the period 1957-1962 counts at Sweasey Dam never exceeded 5.7 spawners/IP-km. Sparkman (2002) estimated a return of 1,419 wild winter-run steelhead from November to March 2000-2001. This equates to four spawners/IP-km. Therefore, it is likely that the population of adult winter-run steelhead in the Mad River is greater than the high risk threshold identified by Spence *et al.* (2008) of 352 adult spawners, but substantially less than low risk threshold of 7,000. Spence *et al.* (2008) wrote that they did not have enough data available on Mad River winter-run steelhead to determine the current population viability.

Summer-run steelhead snorkel surveys for the period 1994-2005 indicate a high of 617 and a low of 80 adults CDFG (2007). From 1994 to 2002, the geometric mean abundance was about 250 with a decreasing trend (Spence *et al.* 2008). Spence *et al.* (2008) concluded that the snorkel survey data on Mad River summer-run steelhead was enough evidence to categorize this population of having at least a moderate risk of extinction. Beginning in 2013, adult summer-run steelhead snorkel surveys on the Mad River were reinitiated by NMFS, CDFW, Green Diamond Resource Company (GDRC), BLM, Mad River Alliance, and others. Snorkel surveys for adult summer-run steelhead provide a low-cost and effective method for monitoring when performed consistently over space and time by trained divers (Spence *et al.* 2008). The CDFW will also be using DIDSON sonar in the Mad River to estimate abundances of adult steelhead beginning in 2014, which could help future long-term salmonid monitoring.

History of Land Use

Historically, bands of the Wiyot Tribe inhabited the lower portion of the Mad River and fished for salmon and steelhead in the watershed (Sturtevant 1978). After whites settled in the area in the mid-1800s, logging and ranching became the primary land uses. Today, logging, road building, gravel mining, grazing, agriculture and water diversion and impoundment are the human activities that have the most pronounced effect on salmonid habitat in the Mad River basin. Mad River Hatchery currently produces approximately 150,000 steelhead smolts annually, supporting a recreational fishery with economic importance to the region.

These land uses have reduced available habitat throughout the basin. The watershed has been heavily logged, some areas more than once, since the early 1900s (Stillwater Sciences 2010). Increased erosion from logged hillslopes and roads, especially during the 1955 and 1964 flood events, has filled the Mad River with sediment and created chronically high turbidity levels (Stillwater Sciences 2008). Although the Mad River basin has naturally high rates of sediment delivery due to unstable hillslopes prone to landslides and high rates of surface erosion, the U.S.

Environmental Protection Agency (USEPA) estimated that 64 percent of all sediment delivered to streams was attributed to human and land management-related activities, with roads being the dominant source (USEPA 2007). In the lower Mad River and North Fork areas, sediment loading is currently five times greater than natural background loading levels (USEPA 2007). Compounding the increase in sediment delivery, riparian vegetation loss has reduced shading and lowered instream large wood abundance. Most forest stands within the basin are now comprised of smaller diameter trees with a greater percentage of hardwoods, which provide different ecological function than redwood and conifer species that occurred historically (GDRC 2006).

Current Resources and Land Management

Much of the North Fork Mad River watershed and the lower and middle portions of the Mad River basin are owned by GDRC and managed for timber production under an Aquatic Habitat Conservation Plan. Grazing occurs on large ranches throughout the Mad River basin, as well as more concentrated grazing along the reaches of the lower river and its tributaries. Most of the upper basin is part of the Six Rivers National Forest (SRNF), and is managed using an ecosystem-based approach that provides for resource protection under the Northwest Forest Plan (FEMAT 1993). The largest communities in the watershed, Arcata, Blue Lake and McKinleyville, are situated along the lowermost reach near the mouth of the Mad River. Extensive instream gravel mining occurs throughout the lower Mad River. Instream gravel mining is focused in the 7-mile reach of the lower Mad River between Blue Lake and Arcata. Extensive instream gravel mining occurs throughout the lower Mad River, although mining practices have greatly improved since the 1970s. The majority of large gravel bars on the lower mainstem Mad River, between Blue Lake and Highway 299, are mined each year, and annual mining typically removes the estimated mean annual recruitment of gravel coming into the mining reach. Although the U.S. Army Corps of Engineers permits gravel mining with numerous mitigation measures, such as a head-of-bar buffer to maintain river flow around the gravel bar and a skim floor elevation that maintains low to moderate channel confinement, gravel mining reduces the availability of complex rearing habitat, and particle size, which could impact aquatic invertebrates and juvenile feeding in the lower Mad River (NMFS 2004; 2010).

The following list highlights important groups or documents that are pertinent to the Mad River:

- Mad River Stakeholders Group: http://www.naturalresourcesservices.org;
- Lindsay Creek Watershed Group: http://www.naturalresourcesservices.org/lindsay-creek.html;

- Mad River Watershed Assessment: http://www.naturalresourcesservices.org/mad-river-watershed-management-plan.html;
- Green Diamond Resource Company: http://www.greendiamond.com;
- Mad River Sediment Source Analysis: http://www.epa.gov/region9/water/tmdl/mad/GMA-Mad-River-SSA-final-report-Dec2007-no-plates.pdf;
- Mad River TMDL: http://www.epa.gov/region9/water/tmdl/mad/Mad-TMDL-122107-signed.pdf; and
- Mad River Alliance: http://www.facebook.com/pages/Mad-River-Alliance/481159968568471.

Salmonid Viability and Watershed Conditions

The following indicators are rated Poor through the CAP process for NC steelhead: aquatic invertebrates (EPT), percent of primary and staging pools, pool/riffle/flatwater ratio, road density, shelter, and turbidity. Other indicators that are identified as impaired include the following: LWD frequency, water temperature, number and magnitude of diversions, estuary quality, and tree diameter. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes (see Mad River CAP results).

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Mad River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Sediment Transport: Road Density

Overall, the sediment load allocations reflect a total 57 percent reduction over the 1976-2006 time period, or an 89 percent reduction in human-and management-related sediment (USEPA 2007). However, because existing management-related sediment loading is so high in the watershed, dramatic cuts in sediment are necessary for habitat improvement (USEPA 2007). Cañon Creek, the North Fork Mad River, Maple Creek, Boulder Creek, Lindsay Creek, the Lower Mad River, and the Lower Middle Mad River all have 50 percent or more of their watershed area in Franciscan Melange, a very erosive geology type. Road building and logging have accelerated erosion rates within this naturally erosive geology. In the lower Mad River and North Fork areas, total sediment loading is currently five times greater than natural sediment loading (USEPA 2007). Most of the hydrologic units within hydrologic sub-areas HSAs in the lower portion of the Mad River watershed, including Little River, Blue Lake, North Fork Mad River, and Butler Valley, have very high road densities of greater than 3 road miles per square mile area. The Lower

Middle Mad River has the largest area underlain by Franciscan Melange (40.4 mi2). Road-related landslides contribute 622,942 tons of sediment per year in the Mad River watershed, making sediment transport a substantial stress to this population (Mad River CAP Results). Sediment accumulation at the mouths of tributaries, such as Cañon Creek, may inhibit juvenile and adult access (D. Halligan, Stillwater Sciences, personal communication, 2011). Excess sediment in the Mad River affects all life stages and all populations of listed salmonids in the basin. High gravel embeddedness likely causes poor survival of eggs and fry in watersheds such as the North Fork Mad River. Elevated turbidity also makes feeding and respiration difficult for fry and juvenile salmonids.

Estuary: Quality and Extent

Estuary condition has a rating of Fair for juveniles in the Mad River (Mad River CAP Results). The estuary was once connected to many sloughs and other off-channel rearing habitat, such as overflow channels and cut-off meanders. Natural slough channels were blocked in the 1900s, and the mainstem river channel was straightened and channelized in an attempt to minimize overbank flooding (Stillwater Sciences 2010). Channel banks in the estuary were stabilized by the construction of gravel berms, riprap, and riparian vegetation planted in the 1980s (Stillwater Sciences 2010) and, as a result, active channel area in the reach has declined by 32 percent since 1941 (Stillwater Sciences 2008). Overall, the relocation of the mouth has increased the size of the estuary, but available estuarine rearing habitat is simplified, with little instream structure or diversity, very little off-channel habitat, and highly altered estuarine function.

Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratios

Sediment loading in the Mad River watershed has aggraded stream reaches, particularly in the lower and middle Mad River watershed. Downstream of the Bug Creek confluence, landslide sediment input exceeds the transport capacity of the river, resulting in a locally aggraded mainstem channel (USEPA 2007). This has caused pools to fill in and become shallow, altering the pool: riffle ratio in several stream reaches. Low LWD volume has also reduced the number and quality of pools in streams in the Mad River watershed. Some short sections of the lower North Fork and lower Mad River mainstem are confined by flood control levees on the right side of the river around the Town of Blue Lake and in the Mad River bottoms, downstream of Highway 101. These levees disconnect the channel from its floodplain and limit the formation of off-channel habitat, which is critical for juvenile winter rearing success.

Habitat Complexity: Large Wood and Shelter

Stillwater Sciences (2010) identified several stream reaches as suffering from low LWD volume. Industrial timber removal of trees, ages 40-80 years, will likely substantially reduce LWD recruitment in the future. However, there is evidence that LWD recruitment is improving in some areas, such as Dry Creek and Cañon Creek (Stillwater Sciences 2010). Areas that are lacking LWD include the Lower Mad River sub-basin, North Fork Mad River sub-basin, Maple Creek, and Powers Creek sub-basin. Surveys conducted by CDFW on Black Creek (a.k.a. Black Dog Creek), located along the west side of the Mad River just upstream of Maple Creek at approximately RM 28.3, identified a relatively low level of LWD and recommended installing wood structures to improve pool habitat quality and instream cover levels (Stillwater Science 2010).

Viability: Density, Abundance and Spatial Structure

Information provided above in the *Abundance and Distribution* section shows that steelhead populations are likely far below the low risk spawner thresholds but above the depensation thresholds. Steelhead have lost 36 percent of their historical habitat due largely to construction of Matthews dam and other impassable barriers. In addition, recent snorkel surveys show that steelhead likely cannot access any habitat above the barrier near the Bug Creek confluence in most years, further limiting their spatial distribution. Poor habitat complexity within the estuary likely limits the expression of life history diversity for steelhead. The high proportion of hatchery steelhead (~75 percent) spawning in streams throughout the lower Mad River watershed likely reduces the reproductive success of the population as whole and has the potential to have undesirable genetic effects.

Water Quality: Turbidity or Toxicity

Analyses detailed in USEPA (2007) indicate there are hundreds of active landslides in the Mad River watershed, which during winter and spring storms create turbid water conditions that stress steelhead parr. Sediment input directly into streams by landslides can also smother available spawning gravel, lowering steelhead survival from the egg to fry life stage. Turbidity is problematic throughout the Middle and Lower Mad River watersheds and in the North Fork Mad River.

Water Quality: Temperature

Instream summer water temperatures are impaired within some portions of the Mad River watershed, particularly the mainstem Mad River and the North Fork Mad River, and likely inhibit juvenile growth and development. However, water temperature data in several tributaries like Lindsay and Hall creeks indicates there are tributaries in the Lower Mad River and North Fork Mad River watersheds that have suitable summertime water temperatures that can support year-round steelhead rearing.

Very Good or Good Current Conditions

A Good rating was given for the following conditions; riparian species composition and structure, floodplain connectivity: quality and extent, hydrology: water flow, passage and migration, watershed hydrology, and landscape disturbance.

Threats

The following discussion focuses on primarily on those threats that rate as High or Very High (Mad River CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Mad River CAP Results.

Channel Modification

Channel modification is a significant threat for juveniles in the Mad River (Mad River CAP Results). The draining of estuary wetlands and construction of high levees for pasture lands has reduced the volume of winter rearing habitat in the lower portions of the watershed, while constructed levees have effectively cut off access to valuable off-channel and slough habitat.

Water Diversion and Impoundments

Water diversions and impoundments affect the function of watershed processes by changing the timing and magnitude of flow events. Matthews Dam, which forms Ruth Reservoir, stores rainfall during the first several rainstorms of the winter season annually spilling after the reservoir is full. This unnaturally attenuates flow in the Mad River, altering the normal hydrologic signal in the Mad River. In years of below average precipitation, flow increases resulting from fall rainstorms are more limited in magnitude, which likely creates barriers to migration at the mouths of some tributaries. Out of basin water diversions or transfer of water from the Humboldt Bay Municipal Water District could pose a significant threat to steelhead in the Mad River by reducing habitat during certain times of year, decreasing flow variability, and elevating stream temperatures.

Roads and Railroads

Roads are a High threat across all life stages, and one of the primary threats for these populations. Most of the hydrologic units within HSAs in the lower portion of the Mad River watershed, including Little River, Blue Lake, North Fork Mad River, and Butler Valley, have very high road densities of greater than 3 mi/sq. mi. Overall, the sediment load allocations reflect a total 57 percent reduction over the 1976-2006 time period, or an 89 percent reduction in human-and management-related sediment, suggesting the threat from roads is decreasing. However, roads remain a significant threat even though the volume of sediment due to human activities has been decreasing (USEPA 2007). This threat will remain High in the future until a plan is developed that systematically prioritizes and treats landslides and roads that contribute sediment to the aquatic environment.

Mining

Mining/gravel extraction presents a High threat to the juvenile life stage. Historic gravel extraction was very damaging to the habitat in the lower Mad River until 1994. Current instream mining practices are improved over past practices. However, gravel extraction still reduces overall habitat complexity and reduces the quality and quantity of available pool habitat. Given the sensitivity of the channel to disturbance (i.e., current lack of floodplain and channel structure; low levels of instream wood), gravel extraction is a high threat to rearing juveniles and a medium threat to adults who require resting habitat in pools during upstream migration.

Logging and Wood Harvesting

Timber harvest is a High threat to steelhead in the Mad River. Many of the changes that have occurred to instream and riparian conditions in the basin reflect legacy effects of more intensive timber harvest from previous decades. The majority of private timber land in the Mad River basin is owned by the Green Diamond Resource Company (Green Diamond), and will continue as timberland into the future. The HCP lays out goals and objectives to minimize and mitigate timber harvest effects through measures related to road and riparian management, slope stability, and harvesting activities. Although the private timber land is managed under an aquatic HCP that reduces the effects of timber harvest, elevated sediment yields, impaired LWD recruitment, and decreased stream shading are still expected to occur in the future.

Hatcheries and Aquaculture

The Mad River hatchery poses a High threat to all life stages of winter-run and summer-run steelhead. Sparkman (2002) found that a high percentage (~75 percent) of adult winter-run steelhead spawning in the Mad River and tributaries were of hatchery origin. More recent monitoring indicates the proportion of hatchery spawners in the Mad River may be closer to 60% in some years. This raises significant concerns for the population in terms of outbreeding depression and reduced productivity associated with the hatchery program. Until CDFW and NMFS agree on a Hatchery and Genetics Management Plan (HGMP), and the hatchery operates in a manner consistent with protocols for an integrated hatchery outlined by the California Hatchery Scientific Review Group (CHSRG 2012) including a proportionate natural influence (PNI) of at least 0.5, this will remain a significant threat to the population. After approval of an HGMP and implementation of hatchery practices consistent with recommendations by the

California Hatchery Scientific Review Group, this threat to steelhead in the Mad River will likely change to a medium to low threat.

Low or Medium Rated Threats

Low or Medium rated threats include agriculture, disease, predation and competition, fire, fuel management and fire suppression, fishing and collecting, recreational areas and activities, residential and commercial development, severe weather patterns, and livestock farming and ranching.

Fishing and Collecting

Fishing and Collecting is rated overall as a Low to summer adults and a medium threat to adult winter steelhead due to an in-river sport fishery. The fishing season for Mad River begins on the fourth Saturday in May and extends through March 31, subject to low flow (200 cfs) closure. Although wild, non-hatchery fish must be released after being caught, there is a popular catch and release fishery for adult steelhead in the Mad River. Regulations do not currently protect these fish during the entire period of low flow conditions that occur coincident with their spawning migration. Anglers are allowed to target adult summer steelhead during low flow conditions in the summer, prior to October 1. Poor summer water quality contributes to the stress of catch and release, and likely results in increased hook-and-release mortalities (Clark and Gibbons 1991). Winter adult steelhead are also subject to stress and mortality associated with the catch and release fishery since fishing is allowed through March 31, a time period which is coincident with their spawning migration. Recovery partners should work with the California Department of Fish and Wildlife to reduce impacts of fishing and collecting on wild steelhead.

Limiting Stresses, Life Stages, and Habitats

The threat and stress analysis within the CAP workbook suggest that winter and summer rearing juvenile steelhead productivity is likely limiting subsequent adult NC steelhead abundance within the Mad River watershed. In addition, strays from Mad River Hatchery likely reduce the overall productivity of the steelhead population. Excessive turbidity during the winter months, along with inadequate stream shading, higher water temperatures, and reduced habitat complexity have reduced the quality and extent of rearing habitat.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Mad River populations is discussed below with more detailed and site-specific recovery actions provided in Mad River CAP results, which provides the Implementation Schedule for this population.

Address Upslope Sediment Sources

Existing problem roads (gullied, rutted, with inadequate drainage) and active erosion sites should be prioritized and addressed as part of a comprehensive sediment reduction plan for the Middle and Lower Mad River subwatersheds, which are the areas with the greatest volume of sediment input (Stillwater Sciences 2010). While Green Diamond Resource Company has been prioritizing their roads for treatment, the work needs to be performed across multiple private ownership boundaries. Because roads are the dominant source of sediment in the watershed, improving road condition and maintenance may be the most cost-effective approach to address elevated turbidity within the watershed (USEPA 2007). The main fish-producing tributaries to the Mad River (Lindsay Creek, North Fork Mad River, Cañon Creek, and Maple Creek) should be treated first (USEPA 2007).

Increase Instream Shelter Ratings and Pool volume

Availability of shelter habitat should be improved within reaches of the Middle and Lower Mad River subwatersheds with currently low pool availability and quality. Adding LWD will improve habitat complexity in existing pool habitats where shelter components are currently comprised of undercut banks and emergent aquatic vegetation. In other reaches, restoration efforts should implement wood/boulder structures into degraded reaches to increase pool frequency and volume. Additions of large wood have occurred in NF Mad, mainstem Mad, Lindsay Creek and Leggit Creek. These efforts have been for the most part successful at improving habitat. Beneficial uses of water from Ruth Reservoir by the Humboldt Bay Municipal Water District should be explored including elevating fall flows during rainstorms, and providing additional habitat for fisheries restoration. Eradication of reed canary grass on Lindsay Creek would further improve the habitat in Lindsay Creek. A new Habitat Conservation Plan for HBMWD would be a valuable step to outline how water no longer needed for industrial uses could be used to benefit salmonids.

Increase Mainstem and Estuary Habitat Complexity

The lower portions of the mainstem Mad River (downstream from Mad River hatchery) suffer from a lack of LWD and, in certain areas, disconnection with the floodplain (near Blue and downstream from Highway 299). Priority should be placed on expanding rearing areas, such as creation of off-channel ponds, wetlands, sloughs, and backwaters, to the lower Mad River, its tributaries and the Mad River estuary. Where possible, land should be purchased from willing landowners in order to expand floodplain habitat availability.

Decrease Water Temperatures

The Mad River is currently listed as water temperature impaired in some parts of the watershed. Water temperature impairment will be addressed through the management of shade by planting conifers to increase riparian vegetation and improving canopy cover.

Complete Mad River HGMP and Update Hatchery Practices

CDFW and NMFS should complete the Mad River HGMP and develop solutions for integrating hatchery and wild NC steelhead populations consistent with recovery goals and guidelines. In particular, a portion of the adult hatchery steelhead run should be removed from the river prior to spawning, or enough wild steelhead should be used in the broodstock, to reduce the genetic threat from hatchery steelhead. Efforts should be made to minimize hatchery steelhead straying.

Passage or Decommission Matthews Dam

Matthews Dam on the Mad River needs to be evaluated for removal or fish passage. In addition, flow bypasses need to be increased to allow salmonid migration, and to increase accessible spawning and rearing habitat.

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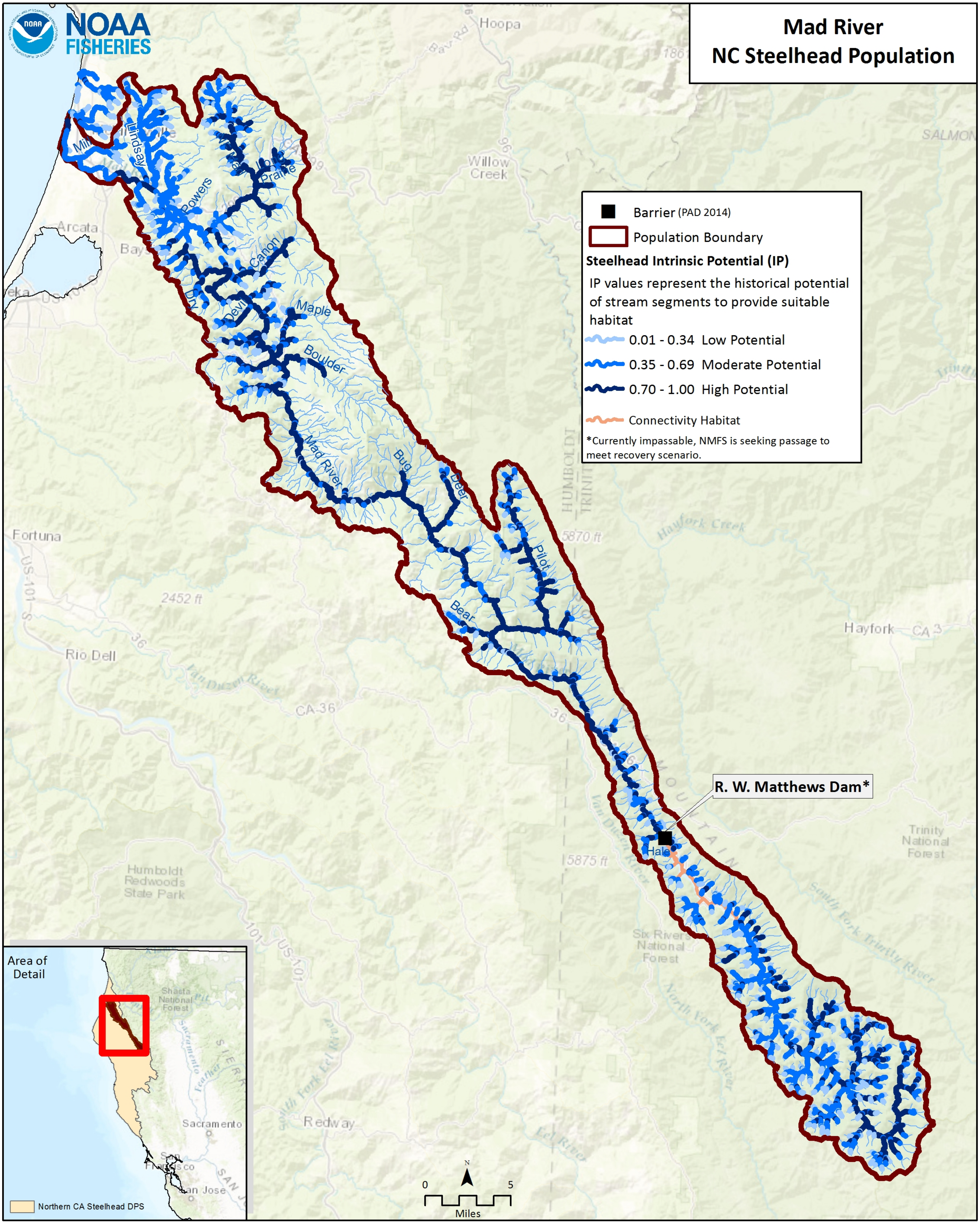
NOAA FISHERIES
Mad River
NC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Connectivity Habitat
*Currently impassable, NMFS is seeking passage to meet recovery scenario.
R. W. Matthews Dam*
Hoopa
Willow Creek
Arcata
Fortuna
Rio Dell
Hayfork
Redway
Lindsay
Powers
Prairie
Canon
Maple
Boulder
Mad River
Bug
Deer
Pilot
Bear
Hale
Area of Detail
Sacramento
Northern CA Steelhead DPS
0
5
Miles

NC Steelhead Mad River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	30% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.15	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	97.27% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	44.52% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		Fair

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	84	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	57.5	Fair
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	10	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	70% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		5.8 spawner per IP-km = >1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 50	Good

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	11	Very Good
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	97% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	84	Very Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	22% of streams/ IP-km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	30% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.15	Good
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 67	Fair

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.3 Diversions/10 IP-km	Fair
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	97.27% of IP-km	Very Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	100% of streams/ IP-km (>70% average stream canopy)	Very Good
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	44.52% Class 5 & 6 across IP-km	Fair
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		Fair
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	84	Very Good
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	97% of streams/ IP-km (>50% stream average scores of 1 & 2)	Very Good
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	57.5	Fair
Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	10	Poor

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	93.51% IP-km (<20 C MWMT)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% of streams/ IP-km maintains severity score of 3 or lower	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	63% of Historical Range	Fair
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	30% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.15	Good

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	97.27% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	44.52% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	84	Very Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	97% of streams/ IP-km (>50% stream average scores of 1 & 2)	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	57.5	Fair
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	10	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
		Size	Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.3 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	60% IP-km (>6 and <14 C)	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	57.5	Fair
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	10	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	70% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	Fair
		Size	Viability	Abundance	Less than the smolt abundance which produces high risk spawner density per Spence et al (2012)	Value between cells F5 and H5.	Greater than the smolt abundance to produce low risk spawner density per Spence et al (2012)		63,918 Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.29% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.4% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	19.12% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	4% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	40% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	5.15 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	4.02 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	50% of streams/ IP-km (>20% staging pool frequency)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 50	Good

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	80% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	97.27% of IP-km	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	11	Very Good
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	97% of streams/ IP-km (>50% stream average scores of 1 & 2)	Very Good
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	84	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	65% mainstem IP-km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
		Size	Viability	Abundance	<1 Spawner per IP-km (Spence et al 2012)		low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair

NC Steelhead Mad River CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
2	Channel Modification	Medium	Low	Medium	Medium	High	Medium	Medium	High
3	Disease, Predation and Competition	Low		Low		Low		Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Low		Low		Medium	Medium
6	Hatcheries and Aquaculture	High		High		High		High	High
7	Livestock Farming and Ranching	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
8	Logging and Wood Harvesting	Medium	Low	High	High	High	High	Medium	High
9	Mining	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Medium	Medium
11	Residential and Commercial Development	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	High	High	High	High	Medium	High
13	Severe Weather Patterns	Medium	Low	Medium	Low	Low	Low	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium	Medium

Mad River (Lower and Upper), Northern California Steelhead (Northern Coastal/North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MadR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat				
MadR-NCSW-1.1.1.1	Action Step	Estuary	Assess and prioritize levees for setback or removal.	2	2	County of Mendocino	
MadR-NCSW-1.1.1.2	Action Step	Estuary	Remove or set back levees, guided by assessment.	2	8	County of Mendocino	
MadR-NCSW-1.1.1.3	Action Step	Estuary	Assess tidally influenced habitat and develop plan to restore tidal channels.	1	2	CDFW	
MadR-NCSW-1.1.1.4	Action Step	Estuary	Restore tidal wetlands and tidal channels, guided by plan.	1	8	CDFW	
MadR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
MadR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed and prioritize potential refugia habitat sites.	2	2	CDFW	
MadR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Implement projects that create refugia habitats, guided by assessment.	2	10	CDFW	
MadR-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
MadR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
MadR-NCSW-3.1.1.1	Action Step	Hydrology	Improve water utilization regulatory mechanisms to increase conservation and reduce diversions.	3	5	RWQCB, SWRCB	
MadR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
MadR-NCSW-5.1.1.1	Action Step	Passage	Develop plan to restore passage of all life stages.	3	2	CDFW	
MadR-NCSW-5.1.1.2	Action Step	Passage	Implement plan	3	8	CDFW	
MadR-NCSW-5.1.1.3	Action Step	Passage	Matthews Dam should be evaluated for removal or fish passage and increased flow bypasses to allow salmonid migration, increase accessible spawning	2	10	CDFW, NMFS	
MadR-NCSW-5.1.1.4	Action Step	Passage	Implement Matthews dam recommendations from above assessment.	2	10	CDFW, NMFS	
MadR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
MadR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop plan to add large wood, boulders, or other instream structure to specific areas in specific quantities.	2	2	CDFW	
MadR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Place instream structures, guided by assessment.	2	8	CDFW	
MadR-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**				
MadR-NCSW-6.2.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
MadR-NCSW-6.2.1.1	Action Step	Habitat Complexity	Reduce removal of instream large wood (i.e., wood poaching)	2	10	NPS, CDFW, County	
MadR-NCSW-7.1	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
MadR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
MadR-NCSW-7.1.1.1	Action Step	Riparian	Determine appropriate silvicultural prescription for benefits to listed salmonids.	3	2	CalFire	

Mad River (Lower and Upper), Northern California Steelhead (Northern Coastal/North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MadR-NCSW-7.1.1.2	Action Step	Riparian	Plant conifers, guided by prescription.	3	10	CalFire	
MadR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-10.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment				
MadR-NCSW-10.1.1.1	Action Step	Water Quality	Develop and fund a feasibility study to address the significant turbidity issues from Ruth Reservoir/Mathews Dam outlet.	2	2	CDFW, NMFS, PGE	
MadR-NCSW-10.1.1.2	Action Step	Water Quality	Fund and implement recommendations from proposed feasibility study to address significant turbidity issues from the Ruth Reservoir/Mathews Dam outlet.	2	5	CDFW, NMFS, PGE	
MadR-NCSW-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
MadR-NCSW-14.1.1.1	Action Step	Disease/Predation/Competition	Eradicate reed canary grass on Lindsey Creek.	2	5	CDFW	
MadR-NCSW-17.1	**Objective**	**Hatcheries**	**Address other natural or manmade factors affecting the species' continued existence**				
MadR-NCSW-17.1.1	Recovery Action	Hatcheries	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
MadR-NCSW-17.1.1.1	Action Step	Hatcheries	Complete MRH HGMP.	3	2	CDFW	
MadR-NCSW-17.1.1.2	Action Step	Hatcheries	Consult on MRH HGMP.	3	1	CDFW	
MadR-NCSW-17.1.1.3	Action Step	Hatcheries	Reduce straying of hatchery steelhead based on HGMP.	3	2	CDFW	
MadR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize increased landscape disturbance				
MadR-NCSW-18.1.1.1	Action Step	Livestock	Assess grazing impact on riparian condition, identifying opportunities for improvement.	3	2	RWQCB	
MadR-NCSW-18.1.1.2	Action Step	Livestock	Develop grazing management plan to meet reduce impacts of grazing on riparian and instream habitat.	3	2	RWQCB	
MadR-NCSW-18.1.1.3	Action Step	Livestock	Fence livestock out of riparian zones.	3	5	Private Landowners	
MadR-NCSW-18.1.1.4	Action Step	Livestock	Plant vegetation to stabilize stream bank.	3	5	Private Landowners	
MadR-NCSW-18.1.1.5	Action Step	Livestock	Relocate instream livestock watering sources.	3	2	Private Landowners	
MadR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
MadR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to watershed hydrology				
MadR-NCSW-19.1.1.1	Action Step	Logging	Amend California Forest Practice Rules to include regulations which describe the specific analysis, protective measures, and procedure required by timber owners and CalFire to demonstrate timber operations described in timber harvest plans meet the requirements specified in 14 CCR 898.2(d) prior to approval by the Director (similar to a Spotted Owl Resource Plan).	3	3	CalFire	
MadR-NCSW-19.1.1.2	Action Step	Logging	Apply BMPs for timber harvest.	3	2	CalFire	
MadR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				

Mad River (Lower and Upper), Northern California Steelhead (Northern Coastal/North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MadR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Minimize mass wasting	3	5		
MadR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	3	2	RWQCB	
MadR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission roads, guided by assessment, away from unstable land features	3	10	Private Landowners	
MadR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	10	Private Landowners	
MadR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Relocate roads away from unstable features.	3	10	Private Landowners	
MadR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	2	Private Landowners	
MadR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
MadR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MadR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	3	20	CDFW, NMFS	
MadR-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MadR-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MadR-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow	3	2	CDFW	
MadR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flow	3	2	CDFW	
MadR-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer	3	2	RWQCB	
MadR-NCSW-25.1.1.4	Action Step	Water Diversion /Impoundment	Review authorized diversions for opportunities to increase instream flow during summer low flow period	3	2	RWQCB	
MadR-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
MadR-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MadR-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Improve water utilization regulatory mechanisms to increase conservation and reduce diversions.	3	25	RWQCB	

Maple Creek/Big Lagoon Population

NC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 2,300 adults
- Current Intrinsic Potential: 71.7 IP-km

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

USFWS (1967) estimated that as recently as the 1960s, Maple Creek supported 3,000 adult steelhead. Steelhead have been observed throughout the Maple Creek watershed (GDRC 2014), with the exception of Gray Creek which has a man-made passage barrier. Green Diamond Resource Company (GDRC) conducted snorkel, electrofishing, and spawning surveys throughout the Maple Creek watershed, although snorkel surveys ended in 2008 and no spawning surveys have been conducted since 2013 (Tables 1 and 2).

Table 1. GDRC Maple Creek snorkel surveys (2002-2008; GDRC 2014).

Stream Reach	Year	# Habitat Units	Dive Count	E-Fish Count
Maple Creek	2002	236	477	9
Maple Creek	2003	125	115	12
Maple Creek	2004	164	-	87
Maple Creek	2005	179	-	106
Lower Maple Creek	2006	132	-	98
Upper Maple Creek	2006	235	-	64
Lower Beach Creek	2006	120	-	22
Lower Maple Creek	2008	139	-	10
Middle Maple Creek	2008	140	-	12

History of Land Use

Timber harvest has been, and continues to be, the predominant habitat stressor within the Maple Creek basin. Intensive logging took place between the 1940s and 1960s, and the legacy effects of removing large, coniferous riparian trees can still be seen in several stream reaches where alders and other hardwood species dominate. Historic logging practices often made use of mill ponds; Gray Creek currently has a remnant dam in place and an associated mill pond. Timber harvest remains the dominant land use at this time, with over 98 percent of the Maple Creek basin owned by GDRC. Current timber harvest regulations and a Habitat Conservation Plan (HCP) have minimized current and future logging-related impacts to aquatic habitat, but many legacy impacts remain to this day and continue to suppress salmonid abundance and survival.

Table 2. GDRC Maple Creek spawning survey (1999-2013; GDRC 2014).

Stream	Year	# Surveys	# Reaches	# Adults	# Redds
Maple Creek	1999	2	1	0	0
NF Maple Creek	1999	1	1	0	0
NF Maple Creek	2000	1	1	0	0
Maple Creek	2002	1	1	0	0
NF Maple Creek	2002	1	1	0	0
Maple Creek	2003	1	1	3	0
NF Maple Creek	2003	2	1	3	2
NF Maple Creek	2005	1	1	4	1
Maple Creek	2008	1	1	4	0
NF Maple Creek	2008	2	1	1	0
Maple Creek	2009	2	1	0	0
NF Maple Creek	2009	2	1	0	0
Maple Creek	2010	2	2	1	0
NF Maple Creek	2010	2	1	3	1
Maple Creek	2011	3	3	6	0
NF Maple Creek	2011	3	1	0	0
Maple Creek	2012	6	4	118	27
NF Maple Creek	2012	2	1	8	3
Maple Creek	2013	1	1	0	0
NF Maple Creek	2013	2	1	0	0

Many roads have been constructed throughout the basin. Logging roads, which are often built alongside streams, have increased erosion rates and altered runoff patterns throughout the watershed. The increased sediment supply has left streams wider and shallower, simplifying instream habitat and infilling many of the deeper pools. In addition, sediment accumulating in Big Lagoon contributes to wetland accretion, a process where sediment deposition can transform active wetland habitat into infrequently inundated marshland. This process has been documented within several areas of lower Maple Creek, including the appearance of alluvial islands downstream of the highway where deeper waters previously existed (Parker 1988).

Other anthropogenic changes affecting sedimentation rates in the estuary and overall estuarine function include the building of Highway 101 and the construction of a dam on Gray Creek. Built in the 1920s, Highway 101 was constructed on dredge spoils across most of the mile-long estuarine floodplain of Maple Creek. Upstream and downstream of the highway, remnant dredge ditches can still be seen. Numerous historic tidal channels were truncated by the highway dike and most (approximately 90 percent) of the historic tidal wetland area has been lost (see Maple Creek/Big Lagoon CAP results). Furthermore, flow from Maple Creek is impeded by Highway 101 during flood events, and backs up on the south side of the highway. The building of the Gray Creek dam has also altered the hydrology of the estuary. In what was historically the upper extent of tidal exchange, the creek now builds up behind the dam in a large lake. Although a channelized stream flowing from the mill pond provides connectivity between the stream and lagoon, tidal exchange has been truncated and a large section of important, tidally-influenced rearing habitat has been lost (see Maple Creek/Big Lagoon CAP results).

Big Lagoon is almost completely encompassed by state lands. Harry A. Merlo State Recreation Area and Humboldt Lagoons State Park almost completely surround the lagoon, while the Department of Fish and Wildlife (CDFW) manages Big Lagoon as a wildlife area. In the early 1900s, farmers wanted to drain the lagoons along the north coast for agriculture. The parks were established along Big Lagoon to protect the lagoons from being converted to agricultural uses. The park includes a campground, day use area, and a boat launch on the south end of the lagoon that is operated by Humboldt County. Recreational use includes camping, kayaking, fishing, and wildlife viewing in the creek and the lagoon.

Limited residential development, with associated paved or graveled roads, occurs just off the southern shoreline of the lagoon and abutting the park; the 20-acre parcel belongs to the Big Lagoon Rancheria Tribe. The community consists of eight homes, a community water facility and an improved road system.

Current Resources and Land Management

Land management within the Maple Creek watershed is dominated by the Green Diamond Resource Company, which owns and harvests timber on 98 percent of the watershed acreage. Smaller landowners include the State of California and the Big Lagoon Rancheria Tribe.

Green Diamond Habitat Conservation Plan

The GDRC HCP (GDRC 2006) outlines a plan for the conservation of aquatic species in the Maple Creek/Big Lagoon. Almost all of the 98 percent of private land in the Maple Creek/Big Lagoon basin is owned by GDRC and, therefore, managed according to the provisions of the HCP. The plan was developed in accordance with ESA section 10 and implementing regulations. The plan has a number of provisions designed to protect salmonids and their habitat throughout the Maple Creek/Big Lagoon basin.

Maple Creek/Big Lagoon Watershed Inventory and Restoration Planning Project Report

The Maple Creek/Big Lagoon watershed inventory and restoration planning report (PCFWWRA 2005) identified locations with future road-related sediment delivery, potential projects that could improve instream channel conditions for anadromous fish, and a prioritized plan of action for erosion prevention and restoration.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, sediment, estuary/lagoon, sediment transport and water quality. Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Maple Creek/Big Lagoon CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Sediment Transport: Road Density

Sediment Transport conditions have a rating of Poor for steelhead in the Maple Creek/Big Lagoon basin. Surveys indicate that excess sediment has filled pools, widened channels, and simplified stream habitat throughout the basin, including the lagoon. The input of fines also increases embeddedness of the spawning gravel and can suffocate eggs during development. In addition to negative stream impacts in the basin, the increased sediment supply accumulates upstream of the bridge and downstream into the mouth of the lagoon (see Maple Creek/Big Lagoon CAP results), reducing the size of the lagoon and rearing habitat.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Gravel quality and quantity is likely poor within the Maple Creek watershed, given that timber harvest is the dominant land-use and high road densities occur throughout much of the basin. Erosion rates are likely highest within steep terrain is traversed by recently constructed or past legacy road networks, especially where problem roads encroach into the riparian corridor. Poor gravel quality likely impacts steelhead eggs and winter rearing juveniles. Eggs can be smothered by fine sediment while in the red, or egg pocket.

Habitat Complexity: Large Wood and Shelter

The condition, Habitat Complexity: Large wood and shelter have a rating of Poor for winter and summer rearing juveniles. Simplified channel and floodplain structure are primarily the result of a lack of large wood in the Maple Creek basin, and an overabundance of fine sediment. Although no surveys of large wood structures are available, the history of intensive logging in the area suggests the basin likely experiences low wood recruitment. Large wood is required to sort sediment, scour pools, and facilitate floodplain connectivity. Surveys in the upper basin indicate pool habitat has been filling with sediment. The oversimplified stream channel and floodplain can no longer provide refugia and rearing habitat for juveniles and lacks habitat features, such as deep pools and side channels.

Water Quality: Turbidity or Toxicity

High winter turbidity is likely a stressful to winter-rearing juveniles and smolts within the Maple Creek and has been rated as Poor. Although turbidity measurements have not been performed, GRDC notes that high sediment loading from failing roads has caused fine sediment to accumulate within the stream channel. During high flows, this fine sediment is likely mobilized into the water column, creating turbid conditions.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The high sediment load within Maple Creek has likely simplified instream habitat features, infilling pools and covering riffle habitat where sediment deposition is most severe. Rearing juvenile steelhead are likely the most impacted lifestage, due to their dependence on streambed macroinvertebrate production for food.

Estuary: Quality & Extent

The impaired estuary/mainstem function stress refers to only the estuary conditions in Maple Creek/Big Lagoon since this is a single population basin. Mainstem conditions are addressed through other stressors, such as floodplain and channel structure, riparian condition, and hydrologic function. Estuary function is important to the population because of its unique role in the life history and survival of steelhead. Estuary conditions for Maple Creek/Big Lagoon have a Poor rating for summer rearing juveniles and smolts.

Big Lagoon is one of the few coastal lagoons that is managed by California Department of Fish and Wildlife (CDFW). Big Lagoon is a brackish lake that is enclosed by a sand spit the majority of the year. Most years, the lagoon breaches, providing adult steelhead access to the basin from the ocean. For the most part, the lagoon habitat provides opportunities for rearing in wetland areas. However, the overall estuarine function has been degraded by sediment accretion and Highway 101. Elevated sediment accretion in the lagoon and in lower Maple Creek has led to a shallowing of tidal channels and conversion of open water to marsh and uplands. An increase of marshland at the rate of 0.23 ha/year was observed between 1931 and 1978 (Parker 1988).

The dike supporting Highway 101 effectively blocks hydrologic connectivity between Big Lagoon and Maple Creek. Numerous large historic tidal channels and tidal wetland have been blocked by the dike. Without tidal exchange, accretion upstream of the highway is converting formally brackish wetland habitat to freshwater wetland, mudflats, and uplands. The conversion from brackish to freshwater wetland has decreased the productivity and rearing potential of wetland areas. Big Lagoon also likely experiences changes due to a loss of exchange with Maple Creek. Riverine flushing is dampened by the dike, potentially impacting salinities, sediment accretion in the lagoon, and breach events at the spit. Based on their work in the small coastal lagoons of Humboldt County, Kraus *et al.* (2008) found that both riverine and ocean processes can affect breach events in these basins. For the barrier spits, small streams and runoff during the rainy season gradually raise the water level and cause breaching from lagoon to ocean by seepage and failure. The pooling of water upstream of the highway can clearly interfere with this process.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

The vast majority of the Maple Creek watershed is actively managed for timber harvest by the Green Diamond Resource Company. Timber harvest and associated road building can increase instream sediment loads through road-related erosion and increased hillslope failure, while logging close to the stream channel can impair riparian habitat function. These impacts have the potential to impact all life-stages of steelhead. GRDC completed an HCP in 2007 with NMFS and USFWS covering their timber operations that attempts to minimize terrestrial and aquatic impacts from logging operations.

Riparian Vegetation: Composition, Cover & Tree Diameter

Degraded riparian forest conditions have a Fair rating for steelhead. Early logging resulted in the harvest of large trees from the riparian zone and the construction of roads alongside streams, so there is a lack of old growth conifers in these areas and many reaches are now dominated by alders. Riparian vegetation should have a diversity of age classes and species that provide a continuous source of large wood input to the stream.

Threats

The following discussion focuses on those threats that rate as High or Very High. Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Maple Creek/Big Lagoon CAP Results.

Logging and Wood Harvesting

As noted earlier, timber harvest is the predominant land-use activity within the Maple Creek basin. Logging on steep or unstable hillslopes can increase the risk of landslides and hillslope erosion, which often accelerates the rate at which sediment accumulates within the stream channel. High sediment loads can increase gravel embeddedness, decreasing egg survival and impair juvenile steelhead food production, while elevated turbidity levels following storm events can physically harm over-wintering juveniles.

Roads and Railroads

Almost all the roads within the watershed are dirt or gravel roads owned and operated by the GDRC, except for Highway 101 and a few paved roads located near the estuary. Unpaved roads are often sources of accumulated fine sediment within streams, especially in areas where high road densities support timber harvesting. The Maple Creek watershed has a high road density in general, and a significant portion of that road development has occurred within or adjacent to riparian corridors. As noted above, fine sediment accumulation can impair streambed function and degrade water quality, affecting all lifestages of steelhead. Highway 101, while not a significant source of sediment, does impair Maple Creek steelhead production and survival by altering natural estuarine processes that create juvenile and smolt steelhead rearing habitat.

Low or Medium Rated Threats

Aside from timber harvest and road development, few threats exist within the watershed. A small dam that impounds an abandoned log-storage pond blocks steelhead access into Gray Creek.

Limiting Stresses, Lifestages, and Habitats

Steelhead lifestages most limiting population viability within Maple Creek are likely egg and juvenile, given the high susceptibility to the effects of elevated fine sediment likely experienced by these two lifestages. Egg survival is likely low in areas exhibiting high fine sediment deposition; similarly, food availability and habitat complexity is likely compromised in these same areas, most affecting juvenile survival throughout the year.

General Recovery Strategy

In general, recovery strategies focus on improving habitat conditions and ameliorating stresses and threats discussed above. The general recovery strategy for the Maple Creek steelhead population is discussed below with more detailed and site-specific recovery actions provided in Maple Creek/Big Lagoon CAP results, which provides the Implementation Schedule for this population.

Reduce Road-related Erosion

Failing or improperly maintained roads are a significant source of the fine sediment accumulations impairing Maple Creek habitat function. The GRDC Habitat Conservation Plan is addressing many of these issues during the next several decades, but resource agencies should assist GRDC in prioritizing restoration actions within high value habitat areas to increase near-term population resiliency.

Increase Habitat Complexity

Recovery actions should focus on habitat restoration to enhance survival and growth of juveniles as well as increase spatial distribution by connecting high quality habitat. Activities that reduce sediment delivery and increase the large wood component of streams would increase habitat complexity and quality of water and substrate. Activities that reduce sediment will also be beneficial to the lagoon/estuary.

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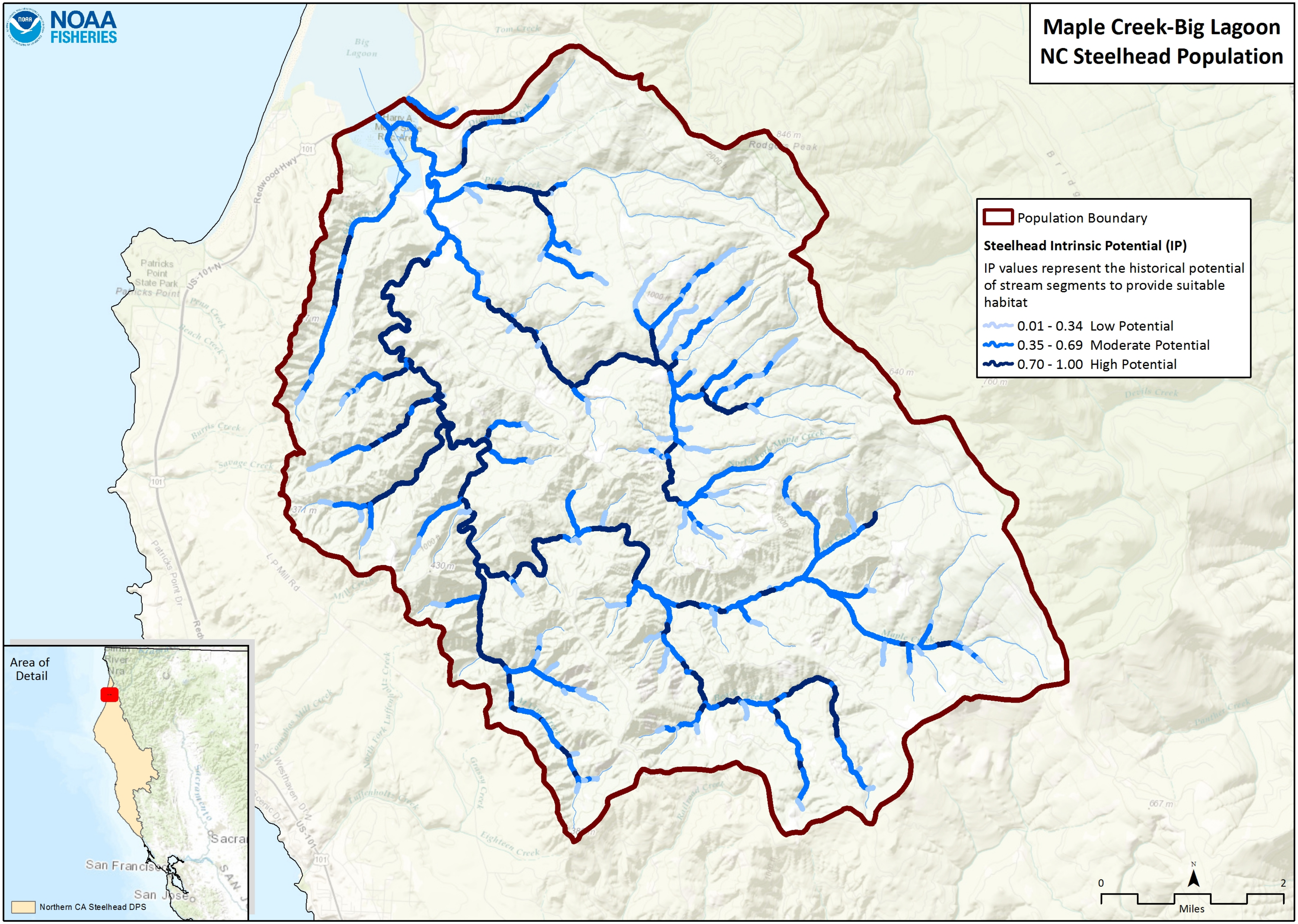

NOAA FISHERIES
Maple Creek-Big Lagoon
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
0
2
Miles

NC Steelhead Maple Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	49.08% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		low risk spawner density per Spence et al (2012)	Good
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% of pools are primary pools)	50% to 74% of streams/ IP-Km (>49% of pools are primary pools)	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)	>90% of streams/ IP-Km (>49% of pools are primary pools)	<50% of streams/ IP-km (>49% of pools are primary pools)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	49.08% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	100% IP-km (<20 C MWMT)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.7 - 1.5 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	49.08% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance to produce low risk spawner density per Spence (2008)	Good

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	1.2% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.33% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	27.87% of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	9.61 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	7.07 Miles/Square Mile	Poor

NC Steelhead Maple Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Medium	Low	Medium	Low	Medium	Medium	Medium
2	Channel Modification	Medium	Low	Medium	Medium	Medium	Medium	Medium
3	Disease, Predation and Competition	Medium	Low	Medium	Low	Medium	Medium	Medium
5	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Low	Medium	Medium	Medium
6	Fishing and Collecting	Medium	Low	Medium	Low	Medium	Medium	Medium
4	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Medium	Low	Medium	Low	Medium	Medium	Medium
8	Logging and Wood Harvesting	Medium	High	Very High	Very High	High	Very High	Very High
9	Mining	Medium	Low	Medium	Low	Medium	Medium	Medium
10	Recreational Areas and Activities	Medium	Low	Medium	Low	Medium	Medium	Medium
11	Residential and Commercial Development	Medium	Low	Medium	Low	Medium	Medium	Medium
12	Roads and Railroads	Medium	High	Very High	Very High	High	Very High	Very High
13	Severe Weather Patterns	Medium	Low	Medium	Low	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Medium	Medium

Maple Creek/Big Lagoon, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MapC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MapC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
MapC-NCSW-1.1.1.1	Action Step	Estuary	Identify parameters to assess condition of estuary and tidal wetland habitat for steelhead appropriate for Maple Creek.	1	5	NMFS	
MapC-NCSW-1.1.2	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics				
MapC-NCSW-1.1.2.1	Action Step	Estuary	Develop a plan to remove Gray Creek dam that will restore tidal wetland habitat and improve hydrologic connectivity.	2	5	CDFW, Green Diamond Resource Company	
MapC-NCSW-1.1.2.2	Action Step	Estuary	Remove Gray Creek dam, guided by assessment.	2	5	CDFW, Green Diamond Resource Company	
MapC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MapC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
MapC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess habitat and develop a plan to restore the historic floodplain through reconnection of sidechannels and offchannel habitat.	1	5	CDFW, Green Diamond Resource Company	
MapC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Restore the historic floodplain, guided by the plan.	1	10	CDFW, Green Diamond Resource Company	
MapC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MapC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
MapC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	Green Diamond Resource Company	
MapC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MapC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
MapC-NCSW-8.1.1.1	Action Step	Sediment	Add channel roughness (logs, boulders) in strategic locations to encourage spawning tailout formations and gravel sorting.	2	20	Green Diamond Resource Company	
MapC-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address disease or predation**				
MapC-NCSW-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
MapC-NCSW-14.1.1.1	Action Step	Disease/ Predation/ Competition	Investigate New Zealand Mud Snail presence in Big Lagoon and Maple Creek. Assess the risk to salmonids and determine a strategy for control if necessary.	2	20	CDFW	
MapC-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Control New Zealand Mud Snails guided by assessment.	2	30	CDFW	
MapC-NCSW-14.1.1.3	Action Step	Disease/ Predation/ Competition	Assess the different exotic species and the abundance of each species in the mill pond behind Gray Creek dam. Develop a plan to eradicate exotic species in conjunction with dam removal.	2	10	CDFW	
MapC-NCSW-14.1.1.4	Action Step	Disease/ Predation/ Competition	Eradicate exotic species, guided by assessment results.	2	30	CDFW	
MapC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**				
MapC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
MapC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Determine impacts of scientific collection on salmonids in terms of VSP parameters.	3	20	NMFS	
MapC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Identify fishing impacts expected to be consistent with recovery.	3	30	NMFS	

Maple Creek/Big Lagoon, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MapC-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Determine actual fishing impacts instream and offshore 200 miles.	2	25	NMFS	
MapC-NCSW-16.1.1.4	Action Step	Fishing/Collecting	If actual fishing impacts exceed levels consistent with recovery, modify management so that levels are consistent with recovery.	2	20	NMFS	
MapC-NCSW-16.1.1.5	Action Step	Fishing/Collecting	Determine impacts of fisheries management on salmonids in terms of VSP parameters.	3	20	NMFS	
MapC-NCSW-16.1.1.6	Action Step	Fishing/Collecting	Identify scientific collection impacts expected to be consistent with recovery.	3	25	NMFS	
MapC-NCSW-16.1.1.7	Action Step	Fishing/Collecting	If actual scientific collection impacts exceed levels consistent with recovery, modify management so that levels are consistent with recovery.	2	20	NMFS	
MapC-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
MapC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
MapC-NCSW-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription for benefits to listed salmonids.	3	50	Green Diamond Resource Company	
MapC-NCSW-19.1.1.2	Action Step	Logging	Thin, or release conifers guided by prescription.	3	5	Green Diamond Resource Company	
MapC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**				
MapC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MapC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	2	10	Green Diamond Resource Company	
MapC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	2	10	Green Diamond Resource Company	
MapC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	2	20	Green Diamond Resource Company	
MapC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	2	25	Green Diamond Resource Company	
MapC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to the estuary (impaired quality and extent)				
MapC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Develop a plan to install bridges on Highway 101 that will increase tidal and riverine exchange, reduce channelization, reduce upland conversion and increase flushing flows to Big Lagoon.	2	20	Caltrans, CDFW, NMFS	
MapC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Install bridges, guided by plan.	2	25	Caltrans, CDFW, NMFS	
MapC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
MapC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MapC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to salmonids.	3	20	County, NMFS	

Mattole River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 10,700 adults
- Current Intrinsic Potential: 534.4 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: NA

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The Mattole River contains two reproductive run-timing ecotypes of steelhead: summer-run that enter freshwater between May and October, and winter-run which enter freshwater between November and April (Busby *et al.* 1996). Busby *et al.* (1996) suggested when summer- and winter-run steelhead co-occur within a basin: (1) they are more similar to each other than either is to the corresponding run type in other basins; (2) summer, or stream maturing steelhead occur where habitat is not fully utilized by winter steelhead; and (3) summer steelhead usually spawn further upstream than winter steelhead. The Mattole River steelhead population also displays the half - pounder life-history pattern. A half-pounder is an immature steelhead that returns to fresh water after only 2 to 4 months in the ocean, generally overwinters in fresh water, then outmigrates to the ocean again the following spring (Busby *et al*. 1996). In other large river systems at the first spawning, adults that displayed the half-pounder life history were smaller than adults that did not display this pattern (Hopelain 1998; Peterson 2011).

In the mid-to late 1950s and in 1960, the average run size of adult steelhead in the Mattole River was estimated at 12,000 (CDFG 1965). Recent population abundance estimates are not available for adult winter run steelhead, but based on survey results an estimated 911 steelhead redds were observed in 2014 and an estimated 389 redds were observed in 2015, and each redd would support at least two spawners (MSG 2016a). Assuming two fish per redd, and recognizing that these surveys are targeted at coho salmon and so miss a substantial portion of the steelhead spawning season, the adult population is likely more than 1000 each year. The number of live fish reported is not a population estimate or a watershed-wide census because survey effort and focus varied each of the years based on available funding.

During summer dive surveys, juvenile steelhead were documented in almost every single reach accessible to adults (MSG 2016b). Also based on these surveys, the lowest average abundance from 2013-2015 was 38 juvenile steelhead per pool (MSG 2016b). Assuming pools average 50 sq. meters (estimate from coho pool data, MSG 2016b) the density would be 0.76 fish/sq. meter.

Snorkel surveys from 1996-2014 documented a low of 9 adult summer steelhead in 2003 and a high of 56 adults in 2013. The 2014 survey documented the second highest count (55) of summer adults, which was also the second highest density of adults observed (0.94 fish/mile) during the survey period (MSG 2015). The Mattole summer steelhead run is special because it persists in a watershed lacking snowmelt, and it represents the southern extent of the life history strategy.

Mattole River juvenile steelhead generally migrate downstream as 2-year old smolts during spring and early summer months; and emigration appears to be more closely associated with size than age, 6-8 inches being the size of most downstream migrants (Downie *et al.* 2003a). Because deployment of the downstream migrant trap is limited to flows around 300 cfs and ends when the mouth closes, which typically allows for sampling from April to into July data do not allow population estimates of juveniles and outmigrating smolts. However, in 2006 through 2011, the majority (82 to 94 percent) of steelhead individuals were age 0+ and numbers ranged from 35,847 in 2007 to a low of 2,442 in 2010 (James 2009; Piscitelli 2011; Piscitelli 2012). The documented downstream movement of age 0+ fish provides further evidence of a steelhead juvenile life history strategy where the tidal freshwater of the lower Mattole River is utilized for rearing by a portion of the population during lagoon formation, as originally described in 1988 and 1989 by Zedonis (1992). Although the number of smolts collected ranged from 84 in 2010, to 377 in 2008, the number, size, and life-history strategy of smolts that may have outmigrated prior to setting of the trap is unknown (James 2009; Piscitelli 2011; Piscitelli 2012). The outmigrant trap has not operated for the past several years.

History of Land Use

The watershed encompasses an area of approximately 194,560 acres (304 square miles) and supports a population of over 2,000 people. The main population centers are in Petrolia, Honeydew, and Whitethorn, although rural residences are scattered throughout the watershed. The majority (84 percent) of the land has a housing density of 1 housing unit or less per 160 ac

(NMFS GIS). However, residences occupy approximately 16 percent of the land adjacent to the mainstem and tributaries of the Mattole River (NMFS GIS). Both historic and current land uses are agriculture and forestry.

High intensity timber management in the basin (wide-scale road building and tractor logging) occurred during the 1950s and 1960s. From 1947 to 1987 an estimated 82 percent of the timber was harvested. By 1988, over 90 percent of old-growth forests had been harvested; and by 1996, late seral habitats comprised less than 8 percent of the original forest cover. A large part of the remaining late seral stage acreage lies within the USBLM King Range National Conservation Area, and 12 percent of the Mattole River watershed lies within this management area. Failure of logging operations to re-establish Douglas fir and other conifers after harvesting allowed for the establishment of more aggressive hardwood species. Once firmly established, hardwood stands are difficult and costly to restore back into conifer. However, conifers will return over time.

Tractor and haul roads cut into logged hillsides, along with high amounts of rainfall, increased erosion and sediment delivery to Mattole River streams. The lack of reforestation also likely contributed to increased sediment loads, which in combination with other disturbances, left streams shallower, warmer, and more prone to flooding (Raphael 1974; Bodin *et al.* 1982). The 1955 and 1964 floods choked channels with sediment, filling deep pools (MRC 2005). Currently, timber harvest continues on private and industrial timberlands in the forested uplands throughout the Mattole River basin at a much-reduced rate and under much stricter regulations. One large industrial timberland owner, Humboldt Redwood Company (HRC), in the Mattole River watershed operates under a state and federal Habitat Conservation Plan (HCP) on 18,350 acres in the western and northern basin (PALCO 1999; HRC 2012).

With the establishment of rural residences and smaller ranches, water use has increased over the last 50 years. Currently, much of the demand for residential and agricultural uses is accommodated through instream diversions or shallow wells, which may be affecting streamflows during summer low-flow periods. Much of the domestic demand occurs in the southern basin. Many areas in the Mattole watershed have experienced increasing levels of marijuana cultivation. Many of these operations require water sources during the summer, which coincides with juvenile steelhead rearing. Water withdrawals in the mid- to late-summer likely play a factor in late summer drying of stream reaches and indirectly reduce survival of juvenile steelhead as a result of stranding in isolated pools. The energy of the water flowing into unscreened water diversions (pumps) may directly increase mortality of juvenile steelhead, either through entrainment of individuals into the diversion pipe or impingement of individuals across the mouth the diversion pipe by the water flow.

Current Resources and Land Management

The estimated land use pattern in the Mattole River watershed (MRC 2005) is comprised of rural residential (32 percent), ranch (31 percent), industrial timberland (13 percent) and conservation (24 percent). Conservation lands include those managed by the U. S. Bureau of Land Management (USBLM), Sinkyone Wilderness State Park, Sanctuary Forest, and the North Coast Regional Land Trust. In addition to ownership and occupation of the land, human activities on the land directly and indirectly affect the quantity and quality of surface water because of the hydrologic connection of the land to the surface and ground water. The quality and quantity of aquatic habitat in the mainstem of the Mattole River, as well as its main tributaries (North Fork Mattole, Upper North Fork Mattole, Mill Creek, Squaw Creek, Bear Creek, Thompson Creek, Honeydew Creek, and Bridge Creek) are affected by the varied land use activities.

The Mattole River Basin Assessment (Downie *et al*. 2003) divided the watershed into five sub-basin planning units (Estuary, Northern, Eastern, Southern, and Western) as an assessment scale upon which to conduct analyses of findings, form conclusions, and suggest improvement recommendations. This assessment identified limiting factors for anadromous salmonids, including poor estuarine conditions, lack of habitat complexity, increased sediment levels, high water temperatures, and inadequate summer flows.

Overall, the current landscape is comprised of either small-diameter conifer forest, or hardwood-dominated forests that provide different ecological functions. Remaining late-seral conifer stands are fragmented and found largely on the public lands in the western and eastern basin. The HRC HCP has a requirement to maintain a minimum of 10 percent late-seral stands on covered lands until 2049 (HRC 2012); and HRC is also designating several late seral stands as "high conservation value forest," which will be protected as long as the company remains the landowner. The HCP includes mitigation strategies related to timber management, forest road construction and maintenance, and rock quarrying. The HCP includes land in the Mattole River watershed. The goals of the HCP are to achieve and move towards properly functioning aquatic conditions for anadromous salmonids within the management area covered by the HCP. To ensure habitat goals are met, the HCP relies heavily on watershed analysis, monitoring, and adaptive management tools.

The conservation ethic and natural resource protection efforts of Mattole residents has been recognized and financially supported by state and federal resource agencies and grant programs for many decades. Since 1985, the various groups within the Mattole River basin collectively have received over $9 million from the California Department of Fish and Wildlife's (CDFW) Fisheries Restoration Grants Program, and NOAA's Pacific Coast Salmon Recovery Fund, NOAA

Restoration Center, and other sources. In addition, the State Water Resources Control Board has contributed significant funding to address water quality problems (*i.e.*, sediment and temperature impairments) in the watershed. In total, more than $15 million has been spent on restoration efforts within the Mattole River basin. Projects include barrier removal, road upgrade and removal, fisheries science, water quality monitoring, and stream bank stabilization.

The Mattole River and Range Partnership (MRRP), formed in 2002, is an unincorporated association of five local nonprofit organizations including the Mattole Restoration Council (MRC), the Mattole Salmon Group (MSG), the Middle Mattole Conservancy, the Mattole Fire Safe Council, and Sanctuary Forest, Inc., working together to develop an enhancement program for the watershed. The MRRP takes responsibility for different aspects of watershed management and recovery, working closely with county, state and Federal government partners.

The following plans and assessments have identified restoration opportunities and facilitated needed changes in land use practices to reduce impacts on aquatic habitat and yet maintain a working landscape:

- Mattole Estuary Restoration 5-Year Plan (USBLM 2012);
- Mattole Headwaters Streamflow Improvement Plan (Trout Unlimited *et al.* 2012);
- The Mattole Forest Futures Project (BBW Associates 2011);
- Mattole Coho Recovery Strategy (MRRP 2011);
- Mattole Integrated Coastal Watershed Management Plan (MRRP 2009a);
- The Mattole Watershed Plan (MRC 2005);
- King Range National Conservation Area Resource Management Plan (USBLM and EDAW 2004);
- Mattole River Watershed Assessment Report (Downie *et al.* 2003);
- Mattole River Total Maximum Daily Loads for Sediment and Temperature (USEPA 2003);
- Mill Creek Watershed Analysis (USBLM 2001);
- Honeydew Creek Watershed Analysis (USBLM 1996);
- Dynamics of recovery: a plan to enhance the Mattole estuary (MRC 1995);
- Bear Creek Watershed Analysis (USBLM 1995); and
- Elements of Recovery (MRC 1989).

Salmonid Viability and Watershed Conditions

Summer rearing juvenile density and spatial structure are rated Good and Very Good, respectively. Smolt abundance is rated as Fair, as is adult density. Due to the low abundance of summer steelhead, this population viability attribute was rated as Poor.

The following indicators were rated Poor through the CAP process for steelhead adults: large wood frequency, percentage of staging pools, floodplain connectivity, water quality (turbidity) and shelter rating and quality of spawning gravel. For eggs, the spawning gravel quality indicators were rated as Poor.

The following indicators were rated Poor through the CAP process for steelhead juveniles: shelter rating, floodplain connectivity, water quality (turbidity), and low summer flows.

The following indicators were rated Poor through the CAP process for smolts: shelter rating and water quality (turbidity and temperature).

Recovery strategies will typically focus on improving these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the Mattole River watershed.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Mattole River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Viability: Density, Abundance, and Spatial Structure

Relative to historic numbers and recovery targets, the abundance of spawning adults is moderate in the Mattole River. Moderate density of summer-rearing juvenile steelhead suggests that the watershed is not functioning at an optimal state. The current spatial distribution of juvenile steelhead is believed to be over 90 percent of historic distribution, likely due to good density and free access to most of the watershed for adults. Expression of known diverse life history outmigration and rearing strategies of juvenile salmonids are limited by the quantity and quality of both freshwater and estuarine habitat.

Hydrology: Baseflow and Passage Flows

Impaired water flow in the spring and summer in the Mattole River tributaries and mainstem have led to the current condition of Hydrology having an overall rating of Poor for adults, juveniles and smolts. Low flow conditions increase water temperatures and even leave some tributaries dry during the summer season, creating an inhospitable environment for rearing and reducing the overall summer rearing habitat availability. The effect of this stress on these life stages is most acute when natural low flow conditions of little or no rainfall during summer and fall months are exacerbated by high rural and residential water use during the same period. Low flows can result in stranding of individuals in disconnected pools, where high water temperature and low dissolved oxygen may become lethal. Isolation of individuals in shallow pools may result in increased risk of exposure to terrestrial predators. Reaches in the southern basin are particularly prone to seasonal drying. Gravel-scouring conditions were rated as Fair for eggs, which is a function of watershed hydrology processes.

Sediment Transport: Road Density

High road densities within the Mattole River watershed are primarily associated with rural residences and timber harvest. The high density (2.26 miles/square mile) of roads within 100-meters of stream channels are of particular concern. Although significant efforts to decommission and upgrade roads have occurred on Federal, county, and some private lands, road density on private lands remains high. Sediment Transport from road conditions has an overall rating of Poor for watershed processes, and is linked to other stresses.

Increased sediment delivery has filled pools, widened channels, and simplified stream habitat throughout the basin including the estuary. The widening of channels in the mainstem and major tributaries has likely exacerbated the rates of streambank failures and channel braiding.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios; Habitat Complexity: Large Wood and Shelter

Habitat Complexity conditions have an overall Poor rating for winter-run and summer-run adults, and summer rearing juveniles. Available data indicate that there are not enough suitable juvenile rearing pools or adult holding pools in the population area. Pool depths are generally poor to fair throughout most of the basin, with the exception of the headwaters region. Pool frequency varies widely, with most of the Very Good ratings occurring in the smaller tributaries of the southern basin. Accelerated delivery of sediment to Mattole River channels from roads and historic timber harvest activities have resulted in aggraded channels and shallow pools. In many reaches streambeds have aggraded, reducing surface flows and limiting downstream passage for migrating juveniles. In addition, the pools available for juvenile use provide insufficient number and diversity of cover elements such as undercut banks, woody debris, and root masses. Data on instream large wood is limited, but does not appear to be a significant limiting factor in the upper reaches of the watershed. In many of the middle and lower mainstem tributaries a lack of large, pool forming wood does appear to be a problem (PALCO 2006). Given the extensive timber harvesting that has occurred in the basin and the changes in riparian vegetation characteristics, lack of large wood is likely limiting, and will continue to limit, the development of complex stream habitat throughout the lower two thirds of the basin. This lack of complex overwintering habitat throughout much of the system may be a major factor in the population decline of steelhead.

Sediment: Gravel Quality and Distribution of Spawning Gravels

The Mattole River is listed as sediment-impaired under section 303(d) of the Clean Water Act (USEPA 2003). Excessive fine sediment can result in poor spawning habitat for adults, suffocate eggs, reduce velocity refugia for winter rearing juveniles, and reduce the productivity of food organisms for winter and summer-rearing juveniles. Sediment conditions have a rating of Poor for summer-run adult steelhead and eggs.

Velocity Refuge: Floodplain Connectivity

Velocity Refuge conditions have a rating of Poor for steelhead summer-run adults and winter-rearing juveniles. The primary indicator for this habitat attribute is availability and abundance of velocity refuge during periods of high flow. Velocity refugia are provided by physical features (*e.g*., pools, large wood) discussed previously, as well as access to and quality of floodplain.

Water Quality: Temperature

Temperature conditions have a rating of Fair for summer-rearing steelhead juveniles. The Mattole River is listed as temperature-impaired under section 303(d) of the Clean Water Act (USEPA 2003). Elevated stream temperatures in the summer and early fall are the result of multiple site-specific factors including reduction of riparian canopy and associated shade, low pool volumes due to excessive sedimentation, and low summer flows due to water diversions. The coolest water temperatures are found in the southern basin, near the community of Whitethorn, where headwater tributaries (Thompson, Mill, Bridge, and Buck creeks) consistently provide cold-water discharge to the mainstem Mattole. In the lower seven miles of the Mattole River, three primary tributaries provide cold-water inflow: Lower Mill Creek, which enters the Mattole at River Mile 2.8; Stansberry Creek at River Mile 1.3; and Lower Bear Creek at River Mile 1.0. Additional sources of cold water in the lower river include Collins Gulch, Jeffrey Gulch, Jim Goff Gulch, Titus Creek, and Tom Scott Creek, although most of these tributaries likely do not flow year-round. However, these tributaries may be sources of subsurface cold water to the mainstem providing some isolated pockets of cool water refugia.

Water Quality: Increased Turbidity

Turbidity conditions has a rating of Fair for steelhead smolts, and is linked to their outmigration during late winter and early spring when Mattole River flows are often high. Increased suspension of sediments, and resultant increased turbidity and decreased water clarity, can cause physical damage to gills, as well as changes in behavior (*e.g*., habitat avoidance, increased foraging). Extended periods of high turbidity during periods of high flow may reduce visibility of prey, and reduce foraging success. Chronic high concentration of fine sediment in the water column, as well as degree of embeddedness of the substrate, can limit availability of epibenthic grazer and predator taxa of benthic macroinvertebrates, an important food source for salmonids.

Riparian Species Composition and Structure

Degraded riparian forest conditions exist across the basin and were rated as Fair for watershed processes, as well as Fair for summer- rearing juvenile steelhead. Streamside canopy cover is variable. Conditions in the southern tributaries are mostly very good, but elsewhere canopy cover exists in a range of conditions. Much of the streamside canopy is either hardwood dominated or of insufficient size to provide large wood. Widespread conversion of forests from conifer- to hardwood-dominant (*e.g*., tanoak and madrone) has likely led to increased fire hazards throughout the basin, as dense hardwoods are prone to high intensity and rapid burns. However, larger and more intense wildfires that remove the hardwoods may, over the long-term, enhance development of conifer-dominated stands in riparian zones.

Passage/Migration: Mouth or Confluence and Physical Barriers

Mouth or Confluence and Physical Barriers conditions were rated as Fair for adults, juveniles and smolts. Numerous culverts in the Mattole River watershed have been upgraded or replaced with bridges, and numerous projects are planned. Few man-made physical barriers (*e.g*., culverts, dams) remain that restrict habitat; however, passage associated with water diversions remains a concern.

Very Good to Good Rated Conditions

Landscape Patterns: Agriculture, Timber Harvest and Urbanization; Hydrology: Impervious Surfaces; Hydrology: Redd Scour

Percent of watershed utilized for Agriculture, Timber Harvest, and Urbanization were rated as Very Good for steelhead, and Hydrology: Impervious Surfaces was rated as Very Good. For watershed processes, the ratings were a result of overall low density of residences, the percent of the watershed with impervious surfaces associated with urbanization, and relatively low percentage of the watershed harvested for timber in the past 10 years.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Mattole River CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Mattole River CAP Results.

Severe Weather Patterns

This threat was rated High for winter-and summer-run adults, eggs, summer and winter rearing juveniles, and smolts, and High for watershed processes. The likely increased frequency of severe weather patterns relative to the past patterns (more frequent storms and increased rainfall in the winter, longer dry periods without rain in the spring, summer, and fall) pose an overall Very High threat to steelhead. Meteorological drought happens when dry weather patterns dominate an area. Hydrological drought occurs when low water supply becomes evident, especially in streams, reservoirs, and groundwater levels, usually after many months of meteorological drought[1,2]. Altered freshwater systems, due to increased air temperatures and changes in the timing, amount and type (*i.e.*, rain vs. snow) of precipitation, are a major climate induced ecosystem concern (Osgood 2008). The primary concerns center on altered streamflows and warmer temperatures affecting survival and passage through tributaries by reducing the available habitat, life history diversity and freshwater survival rates for juvenile salmonids.

Increased frequency and magnitude of flows from storms and flooding in the winter are likely to increase redd scour and may affect the quantity and quality of spawning gravels, and the amount and quality of pool habitat in many watersheds. Growth and survival of winter rearing juveniles without access to both instream and off-channel velocity refugia are likely decreased due to potential flushing from the system during flood flows. In addition, lack of access to the floodplain during high flows limits the opportunity for feeding on riparian invertebrates.

In the summer, stream reaches currently experiencing temperatures near the thermal maxima for juvenile salmonids may become uninhabitable, and currently habitable reaches may become thermally marginal. Rainfall patterns may or may not exacerbate water temperature problems. Areas subject to low summer flows may experience further summer flow decreases. Water withdrawals that are currently of limited impact on salmonids may increase in impact as streamflows diminish.

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[1] http://www.ncdc.noaa.gov/climate-monitoring/dyk/drought-definition
[2] http://www.cpc.ncep.noaa.gov/products/outreach/glossary.shtml

Water Diversions and Impoundments

This threat was rated Very High for summer adults and summer rearing juveniles, and High for smolts and watershed processes. There are no large long-standing dams within the Mattole River watershed. However, concerns regarding irrigated agriculture and sub development of parcels could increase water demand and further reduce spring and summer streamflows. Additionally, future streamflow alterations could alter the hydrodynamics of the estuary during the summer months. Water diversions for existing and future residential and agricultural development should be regulated to keep from reducing summer and spring baseflows or groundwater recharge to the extent that rearing habitat functions are impaired. Greater participation in programs to cease pumping when mainstem flows reach 0.7 cfs are likely to result in measurable increases in low summer streamflows (Sanctuary Forest Inc. 2014). An ongoing Sanctuary Forest forbearance program, where water is stored in tanks during the winter for spring and summer use, will continue to reduce the effect of summer and spring water diversions in the southern basin. However, this program alone is likely not sufficient to eliminate this threat.

Roads and Railroads

This threat was rated High for all life-stages and watershed processes. Because of the previously discussed relationship among road networks, accelerated transport of sediment and water to stream networks and subsequent habitat degradation, decommissioning efforts on problem roads where feasible as well as creation of more efficient transportation networks will minimize further salmonid habitat degradation within the watershed.

Logging and Wood Harvesting

Logging and wood harvesting was rated as a High threat to smolts. Timber harvest practices have improved greatly within the bounds of the Conservation Fund property. However, other portions of the watershed still face the potential for accelerated timber harvest and high impact harvest techniques. Additionally, habitat degradation (e.g., gravel quality, water temperature, instream wood recruitment) associated with past timber harvest persists throughout the watershed, although some processes are currently in a state of recovery. The Mattole Forest Futures Program will facilitate improved forest management practices in the Mattole River watershed. Implementing the Program will provide an alternative regulatory pathway for timber harvest approval, containing extensive environmental protection measures which require less analysis (and thus cost less) than more intensive actions allowed under the California Forest Practice Rules (FPR). Landowners who agree to engage in "light touch" timber harvest may tier to this watershed-wide environmental review of the impacts of these specific practices, greatly simplifying the plan preparation process on most private parcels. Future management and recovery actions need to protect salmonid habitat from degraded water quality conditions (turbidity and increased temperature) associated with timber harvest, and ensure the continuation of watershed rehabilitation efforts.

Low or Medium Rated Threats

Residential and Commercial Development

This threat was rated Medium for winter-run and summer-run adults, summer and winter-rearing juveniles, smolts, and watershed processes, and Low for eggs. Because residences and businesses are connected by roads and will require water, planning and permitting of future development should minimize the reduction of streamflows and minimize sediment delivery to streams.

Agriculture; Livestock Farming and Ranching; Fire, Fuel Management and Fire Suppression; Recreational Areas and Activities

These threats were rated as Medium for summer rearing juveniles and Low for winter-run adults. Agriculture was rated as a Medium threat for summer-run adults, and smolts. Livestock ranching was rated as a Medium threat to summer-run adults, winter-rearing juveniles, and smolts. Regulation of land use activities under the Humboldt County General Plan, implementation of USDA Natural Resource Conservation Service best management practices, and preparation of updated fire plans, should continue and should include provisions to minimize erosion and maintain water quality.

Fishing and collecting

Fishing and collecting was identified as a low threat to winter adults, summer rearing juveniles, smolts, and a moderate threat to adults holding in the summer. Fishing is allowed for hatchery steelhead between the fourth Saturday of May and August 31 in an area of the main stem where adult summer steelhead have been documented to hold and at a time when they are present.

Limiting Stresses, Lifestages, and Habitats

Based on the type and extent of stresses and threats affecting the populations as well as the limiting factors influencing productivity, it is likely that the juvenile lifestage is most limited and that quality summer and winter rearing habitat is lacking as vital habitat for juvenile steelhead. Juvenile summer rearing habitat is impaired by reduced baseflows and high stream temperatures with few thermal refugia areas accessible. All lifestages are limited by the lack of channel complexity throughout the basin. The lack of habitat forming features (e.g., large wood) results in inadequate pools and riffles, reduced cover, and reduced velocity refuge for salmonids. In addition, the egg lifestage is likely limited by elevated fine sediment that reduces survival to emergence in many spawning areas of the Mattole River.

General Recovery Strategy

Recovery strategies generally focus on improving instream habitat conditions and ameliorating stresses and threats, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions. The general recovery strategy for the Mattole River steelhead populations are discussed below with more detailed and site-specific recovery actions which provides the Implementation Schedule for this population. Implementation of recovery actions may integrate the outcome of past planning efforts (Downie *et al.* 2003b; MRC 2005; MRRP 2009b), *e.g.*, sub-basin delineation, action prioritization, social capital of existing private/public partnerships, completed and ongoing habitat restoration and streamflow improvement projects. To ensure that the recovery actions have the desired outcome of a self-sustaining population of steelhead in the Mattole River, monitoring of the habitat indicators, as well as the fish populations, may be necessary. Creative partnerships will be the key to leveraging funding and habitat benefits.

Improve Estuary Habitat

Restore the physical and biological attributes of the estuary, including the north and south bank slough channels. Improve juvenile rearing habitat by increasing in-water structure and overwater cover. Provide fish passage at and hydrologic connection of Bear Creek to the lower Mattole River.

Improve Summer Baseflow

Conduct outreach with landowners and residents to decrease diversion of ground and surface water during the summer months. Support research (*e.g.*, Mattole River Headwaters SIP) that focuses on improving groundwater recharge in tributary streams. Increase streamflow in the headwater regions using regulatory mechanisms, developing a water budget, encouraging water conservation, and increasing the participation in the forbearance program. Promote water conservation during low-flow periods. Consider feasibility of fish rescue and relocation or rearing. Use the streamflow improvement plans and streamflow thresholds for juvenile salmonid rearing habitat, currently underway in the Mattole Headwaters Southern sub-basin (Trout Unlimited *et al.* 2012), as a model for other sub-basins.

Improve Stream Temperatures

The approach to improving riparian conditions in the basin should focus on minimizing further loss of riparian vegetation and on rehabilitating riparian areas that are currently in poor condition, which primarily occur in the inland subbasins of this watershed. The recovery of riparian function will improve LWD recruitment, but also is expected to improve water quality with respect to stream temperatures for salmonid rearing.

Improve Instream Habitat Complexity

Improve large woody frequency across the Mattole River watershed. Riparian areas are in the process of recovery with stands of smaller diameter conifers that currently buffer stream areas. Addition of wood to the river and its tributaries will provide much-needed complexity to the stream channel until riparian areas reach maturity and begin to recruit naturally to channels. Large wood will improve instream habitat attributes, *e.g.*, pool and riffle frequency and habitat complexity; provide important refuge from high flow events; and increase growth and survival of juveniles during winter and summer. Information from existing plans and from groups such as the Mattole Salmon Group should be utilized in determining high priority streams for large wood restoration projects.

Improve Substrate Quality

Continue efforts to reduce sediment delivery from past management caused sources of roads, timber harvest, grazing, and agriculture. Over the past few decades the Mattole Restoration Council's Good Roads Clear Creeks Program has been working systematically through the watershed to upgrade and reduce sediment sources (MRC 2012). Implement remaining road and other sediment reduction projects. Continue efforts to improve water quality by reducing erosion of streambanks from livestock grazing, and off-road vehicle recreational activities.

Improve Fishing Regulations

Fishing regulations should be developed that would afford greater protection to summer steelhead, which are extremely vulnerable during the summer hatchery steelhead fishery that occurs in part of the Mattole mainstem.

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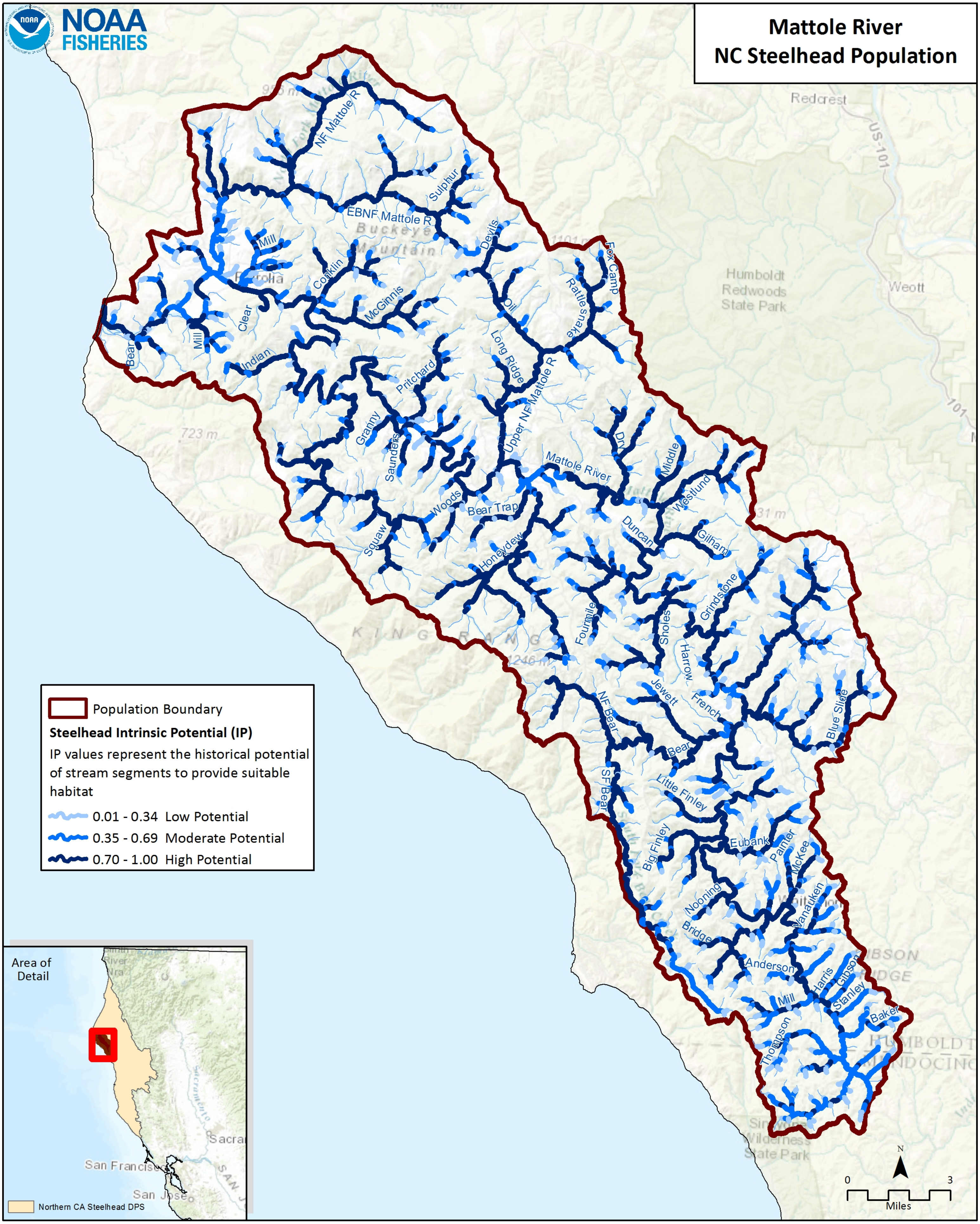
NOAA FISHERIES
Mattole River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
NF Mattole R
Sulphur
EBNF Mattole R
Mill
Petrolia
Conklin
Devils
Fox Camp
Rattlesnake
Oil
McGinnis
Clear
Mill
Bear
Indian
Long Ridge
Upper NF Mattole R
Pritchard
Granny
Saunders
Dry
Mattole River
Middle
Westlund
Woods
Bear Trap
Squaw
Honeydew
Duncan
Gilham
Grindstone
Fourmile
Shoals
Harrow
Jewett
French
Blue Slide
NF Bear
Bear
SF Bear
Little Finley
Big Finley
Eubank
Painter
McKee
Nooning
Vanauken
Bridge
Anderson
Harris
Gibson
Stanley
Mill
Baker
Thompson
Redcrest
US-101
Humboldt Redwoods State Park
Weott
Buckeye Mountain
KING RANGE
723 m
1246 m
1101 m
HUMBOLDT
MENDOCINO
GIBSON RIDGE
San Francisco
San Jose
Sacra
0
3
Miles
N

NC Steelhead Mattole River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	51% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	11% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.17	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.5% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	42.25% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	45.4	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	68.12	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	14.71	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)		low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	19.57	Poor

			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	26% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	45.4	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/nonfunctional	Impaired but functioning	Properly functioning condition		Impaired/nonfunctional	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	56% of streams/ IP-km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	51% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	11% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.17	Good
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor

Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP km	Poor
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.5% of IP-km	Very Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	52% of streams/ IP-km (>70% average stream canopy)	Fair
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	42.25% Class 5 & 6 across IP-km	Fair
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	45.4	Fair
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	26% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	68.12	Good
Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	14.71	Fair

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	53.33% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.7 - 1.5 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	51% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor

			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.17	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.5% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	42.25% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	45.4	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	26% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	68.12	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	14.71	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/nonfunctional	Impaired/functional	Proper functioning condition		Impaired/functional	Fair

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	11% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	<50% IP-km (>6 and <14 C)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	68.12	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	14.71	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.07% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	7.35% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.96 Miles/Square Mile	Fair
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.39 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	<50% of streams/ IP-km (>20% staging pool frequency)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	11% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.5% of IP-km	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	19.57	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	26% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	45.4	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
		Size	Viability	Abundance	<1 Spawner per IP-km (Reference Spence)	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		<1 Spawner per IP-km (Reference Spence)	Poor

NC Steelhead Mattole River CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Low	Low	Medium	Low	Medium	Low	Medium	Medium
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low	Low
3	Disease, Predation and Competition	Low		Low	Medium	Medium	Low	Medium	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low	Low
5	Fishing and Collecting	Medium		Low		Low		Medium	Medium
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Low	Low	Medium	Medium	Medium	Low	Medium	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	High	Medium	Medium	High
9	Mining	Low	Low	Low	Low	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	High	High	High	High	High	High	High	Very High
13	Severe Weather Patterns	High	High	High	High	High	High	High	Very High
14	Water Diversion and Impoundments	Medium	Low	Very High	Medium	High	High	Very High	Very High

Mattole River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MatlR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatlR-NCSW-1.1.1	Recovery Action	Estuary	Increase extent of estuarine habitat				
MatlR-NCSW-1.1.1.1	Action Step	Estuary	Identify impaired areas of estuary and convert these areas to functioning tidal habitat.	3	2	BLM	
MatlR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatlR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
MatlR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Develop plans to create off-channel ponds, alcoves, and backwater habitat throughout watershed, including in lower river/estuary.	1	10	BLM	
MatlR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Create habitat guided by plans.	1	20	CDFW, NGO, NMFS	
MatlR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Reconnect the floodplain to the channel.	1	20	NGO	
MatlR-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
MatlR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
MatlR-NCSW-3.1.1.1	Action Step	Hydrology	Ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB	
MatlR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatlR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
MatlR-NCSW-5.1.1.1	Action Step	Passage	Investigate alternatives and provide fish passage at the Bear Creek/Lighthouse Road crossing.	2	5	County	
MatlR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatlR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
MatlR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Carry out habitat assessments to determine location and amount of large wood or other structure needed, and add structure guided by assessments.	2	10	CDFW	
MatlR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Provide for natural large wood recruitment.	2	10	Calfire, CDFW, NGO, NMFS, Private Landowners	
MatlR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Develop prescription to manage riparian forests to promote late-seral characteristics while maintaining bank stability and existing shade	3	10	Calfire, CDFW, NGO, NMFS, Private Landowners	
MatlR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Plant conifers as guided by prescription.	3	20	NGO, Private Landowners	
MatlR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Thin from below, or release conifers, guided by prescription.	3	20	Private Landowners	
MatlR-NCSW-6.1.1.6	Action Step	Habitat Complexity	Increase large wood frequency throughout watershed, including in lower river/estuary.	2	10	Calfire, CDFW, NGO, NMFS, Private Landowners	
MatlR-NCSW-6.1.1.7	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	5	NGO	
MatlR-NCSW-6.1.1.8	Action Step	Habitat Complexity	Add structure, guided by plan.	2	10	NGO	
MatlR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)				
MatlR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Implement actions to improve pool/riffle/flatwater ratios.	1	25	NGO	
MatlR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Develop and implement plan to recreate off-channel ponds, alcoves, and backwater habitat	2	20	NGO	
MatlR-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**				
MatlR-NCSW-6.2.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
MatlR-NCSW-6.2.1.1	Action Step	Habitat Complexity	Reduce removal of instream large wood (i.e., wood poaching)	2	10	NPS, CDFW, County	
MatlR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MatIR-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
MatIR-NCSW-7.1.1.1	Action Step	Riparian	Remove invasive species that inhibit establishment of native riparian vegetation.	3	20	NGO	
MatIR-NCSW-7.1.1.2	Action Step	Riparian	Plant native riparian species in open areas.	3	20	NGO	
MatIR-NCSW-7.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
MatIR-NCSW-7.2.1	Recovery Action	Riparian	Improve riparian conditions				
MatIR-NCSW-7.2.1.1	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	20	NMFS, Calfire, BOF	
MatIR-NCSW-7.2.1.2	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	20	Calfire, BOF	
MatIR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatIR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
MatIR-NCSW-8.1.1.1	Action Step	Sediment	Assess potentially large inputs of fine sediments that are imminent and will affect occupied areas (i.e. failing banks, failing culverts, failing roads)	2	10	CDFW, RWQCB, Counties	
MatIR-NCSW-8.1.1.2	Action Step	Sediment	Treat potentially large inputs of fine sediments that are imminent and will affect areas occupied by salmonids (i.e., failing banks, failing culverts, failing roads)	2	10	CDFW, RWQCB, Counties	
MatIR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatIR-NCSW-10.1.1	Recovery Action	Water Quality	Prevent or minimize impairment to water quality (instream water temperature)				
MatIR-NCSW-10.1.1.1	Action Step	Water Quality	Identify areas in need of more shade, describe timber management methods that will increase shade over time, and implement methods in identified areas.	3	10	Calfire, CDFW, NGO, Private Landowners	
MatIR-NCSW-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatIR-NCSW-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to water quality (instream water temperature)				
MatIR-NCSW-12.1.1.1	Action Step	Agriculture	Assess effects (e.g., flow, water quality) of marijuana cultivation.	1	20	NMFS	
MatIR-NCSW-12.1.1.2	Action Step	Agriculture	If needed, develop plan to reduce effects of marijuana cultivation.	1	20	NMFS	
MatIR-NCSW-12.1.1.3	Action Step	Agriculture	Implement plan.	1	20	NMFS	
MatIR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
MatIR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
MatIR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	3	5	CDFW, NMFS	
MatIR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Title 14, Section 8.00 (b) low flow restrictions to close fishing during periods of low flow.	3	5	CDFW, NMFS	
MatIR-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Modify fishing regulations to protect summer steelhead.	2	5	CDFW, NMFS	
MatIR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatIR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to water quality (instream water temperature)				
MatIR-NCSW-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation and fence livestock from these areas.	2	10	NRCS, RCD	
MatIR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
MatIR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				

Mattole River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MatIR-NCSW-19.2.1.1	Action Step	Logging	Amend California Forest Practice Rules to include regulations which describe the specific analysis, protective measures, and procedure required by timber owners and CalFire to demonstrate timber operations described in timber harvest plans meet the requirements.	3	50	CalFire	
MatIR-NCSW-19.2.1.2	Action Step	Logging	Apply BMPs for timber harvest	3	100	Private Landowners	
MatIR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**				
MatIR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MatIR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess streamside roads and prioritize sites for relocation.	3	20	NGO	
MatIR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Identify and prioritize existing roads that are no longer necessary for silvicultural operations.	3	30	NGO	
MatIR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Maintain/stabilize roads and hill slopes, guided by assessment.	3	100	NGO, Private Landowners	
MatIR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	50	Private Landowners	
MatIR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Relocate roads away from unstable land features.	3	20	CDFW, Private Landowners	
MatIR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Develop plan to decommission roads.	3	30	NGO	
MatIR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Decommission roads throughout watershed.	3	20	Private	
MatIR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
MatIR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MatIR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	3	5	County	
MatIR-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatIR-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
MatIR-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Review authorized diversions for opportunities to increase instream flow during summer low flow period.	1	10	CDFW, SWRCB	
MatIR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer.	1	10	CDFW, SWRCB	
MatIR-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Identify unauthorized diversions.	1	10	CDFW, SWRCB	
MatIR-NCSW-25.1.1.4	Action Step	Water Diversion/Impoundment	Enforce existing regulations to cease unauthorized diversions.	1	10	State	
MatIR-NCSW-25.1.1.5	Action Step	Water Diversion /Impoundment	Create water budgets to avoid over-allocating water diversions.	1	10	CDFW, SWRCB	
MatIR-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MatIR-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
MatIR-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow.	1	10	RQCB, SWRCB, CDFWRQCB, SWRCB, CDFW	

Mattole River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MatlR-NCSW-25.2.1.2	Action Step	Water Diversion/Impoundment	Implement forbearance program.	2	10	State	
MatlR-NCSW-25.2.1.3	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flow.	1	5		

Redwood Creek Population

NC Steelhead Winter-Run

Lower Redwood Creek

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 3,200 adults
- Current Intrinsic Potential: 161.1 IP-km

Upper Redwood Creek

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 2,600 adults
- Current Intrinsic Potential: 86.2 IP- km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal/North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: NA

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Various monitoring programs are used to estimate NC steelhead abundance and distribution within the Redwood Creek watershed. Since 2000, CDFW has operated a juvenile out-migrant trap in the middle portion of mainstem Redwood Creek at river mile 34 (known as the upper trap), and since 2004 CDFW has also operated a juvenile outmigrant trap in the lower portion of mainstem Redwood Creek at river mile 4 (known as the lower trap). A juvenile outmigrant trap has also been in operation since 2011 in Prairie Creek, near its confluence with mainstem Redwood Creek; previously (years 1998 to 2001) the trap was located near the middle of Prairie Creek. Seining also occurs in the estuary from June to October each year to estimate population abundance. Summer NC steelhead dive surveys have been done in an index reach of mainstem Redwood Creek since the 1980s and spawner surveys have been conducted in Prairie Creek since 1999, and in the entire basin since 2009; however, spawner surveys focus on salmon and do not continue past March or April, and miss some of the winter run of steelhead. A dual frequency identification sonar (DIDSON) unit has also been in mainstem Redwood Creek from 2009 to the present to help determine adult abundance by using sonar to estimate the number of adult fish migrating past the DIDSON unit. Numerous issues still need to be addressed with using DIDSON to estimate escapement, including differentiating between migrating adults of different species with overlapping run timing. In addition, the DIDSON has not been operated for the entire run timing of winter steelhead.

Abundances of age 1+ and age 2+ steelhead in upper Redwood Creek have shown significant (p <0.10) negative trends over the study years between 2000 and 2010 (Sparkman 2011c). Sparkman (2011a) reported an age 1+ steelhead population estimate of 28,323 (24,546 – 32,101) in 2010, which was 24 percent less the previous 10 year average abundance. The abundance estimate for age 2+ steelhead in 2010 was 3,015 (2,311 – 3,719), which was 34 percent less than abundance for the previous 10 year average (Sparkman 2011a).

The total number of age 1+ and age 2+ juveniles caught at both the lower Redwood Creek trap, and the Prairie Creek trap (i.e., total smolt population estimate for the basin) was 31,055 in 2011; 42,181 in 2012; 37,734 in 2013; and 60,719 in 2014 (M. Sparkman, CDFW, personal communication, 2015). Using the common, but rough, estimate of 1 percent ocean survival would yield adult population estimates (based on the smolt estimates) of between 310 adults and 607 adults during 2011 to 2014. Recent information from Sparkman *et al.* (2016) indicates that steelhead abundance continues to be above the depensation level, but below the 5,400 adults needed for recovery.

Anderson (2011a) estimated population abundance of steelhead in the Redwood Creek estuary from 2004 through 2011; estimates ranged from a high of 39,380 steelhead during one sampling interval in 2004, to a low of 300 in 2005 when the river mouth was open to the Pacific Ocean. Steelhead abundance in the estuary habitat decreased in most years when the mouth was closed (Anderson 2011a).

Ricker (2011a; 2011b) conducted spawning surveys and carcass counts in reaches throughout the Redwood Creek basin in 2009-2010 (November to March) and 2010-2011 (November to April). In 2009-2010 they observed 35 live steelhead, no identifiable steelhead carcasses (but 5 unidentified salmonid carcasses), and 98 identified or predicted steelhead redds, and in 2010-2011 they observed 33 live steelhead, 1 steelhead carcass (and 4 unknown salmonid carcasses), and 59 identified or predicted steelhead redds. However, the steelhead redd surveys were conducted under the GRTS coho salmon sampling frame, and did not cover all spawning areas used by steelhead. In addition, the spawning surveys are focused on salmon and end in March or April, with winter run steelhead adults continuing to enter the system and spawn in May in most years

(M. Sparkman, CDFW, personal communication, 2015). From the DIDSON imagery, Metheny (2012) estimated that in 2009 approximately 520 steelhead entered Redwood Creek (includes Prairie Creek) to spawn. In 2013-2014, winter run steelhead abundance was estimated at 1500 adults based on DIDSON imagery (M. Sparkman, CDFW, personal communication, 2015) near the upper outmigrant trap site.

Regarding the summer-run steelhead population, RNP conducted summer steelhead surveys for 35 consecutive years, beginning in 1981 through and including 2015, and observed 0-44 adult summer steelhead in the original 16-mile index reach of mainstem Redwood Creek (RNP 2015). In 1992 the survey reach was expanded to 24.1 miles and numbers in the expanded reach have ranged from 3 to 22 adults. The most adults ever counted, 59 adults in 2008, covered 39 miles, 58% of mainstem Redwood Creek (D. G. Anderson, Redwood National and State Parks, personal communication, 2016).

Although not a basin-wide estimate of adult NC steelhead abundance, Duffy (2011) found from 4 to 142 adult steelhead annually in Prairie Creek between 1999 to 2011, with an average of 40 adults per year in the 13-year monitoring program. Duffy's 2011 monitoring in Prairie Creek also shows a negative trend in abundance over the 13-year monitoring period.

In general, steelhead are widely distributed throughout the Redwood Creek basin, although many of the tributaries steepen quickly into headwater drainages and their steep channel gradient limits access to the upper portions of many tributaries. Reductions in the quality and quantity of deep holding pools in mainstem Redwood Creek and its large tributaries also likely limits the distribution of summer-run steelhead adults. Cover and shelter from predation is especially important to summer steelhead, especially when considering the low quality and quantity of pool habitat in the basin; otters and other predators may play an important role in limiting summer steelhead abundance in Redwood Creek (M. Sparkman, CDFW, personal communication, 2015).

History of Land Use

The Redwood Creek basin reflects a long legacy of watershed disturbance, primarily through intensive timber harvest and associated road building, the construction of flood control levees and through conversion of wetlands and bottom lands to agricultural production. Timber harvest cleared the majority of floodplain and valley bottom areas within the basin by the latter half of the nineteenth century. Commercial timber harvest within the greater watershed started in the 1930s. Several upper slopes and ridge tops were logged by 1936, and by 1948 approximately 6 percent of the watershed had been harvested (Best 1995). From 1949 to 1954, approximately 27 percent of the original forested land and 22 percent of the watershed was harvested with the majority of harvest occurring in the upper and middle watershed. From 1955 to 1962, approximately 15 percent of the watershed was logged with a larger portion from within the lower watershed. The 1966 aerial photos showed that approximately 55 percent of the original coniferous forests were logged from 45 percent of the drainage (Best 1995). Unfortunately, the majority of the 1963 to 1966 harvest within the upper watershed occurred within the Redwood Creek inner gorge and its steeper tributaries. This required the construction of numerous roads and tractor yarding trails that significantly increased the frequency and magnitude of landslides during the December 1964 flood. The sediment mobilized from the 1964 flood significantly aggraded much of Redwood Creek and its tributaries, resulting in wide and shallow, simplified stream habitat with a lack of pools and instream structure.

From 1966 to 1970, logging continued at a similar rate, with tractor logging the primary yarding method. By 1970, nearly 65 percent of the original coniferous forest or 53 percent of the watershed was logged. As old-growth forests declined in the 1970s, commercial companies began re-entering previously harvested areas to remove residual old-growth from previously logged areas. At the end of Best's 1995 study period in 1978, over 80 percent of the original forests were logged, or 66 percent of the watershed. The aerial photos show that nearly 69 percent of the original forests in the lower watershed, 92 percent in the middle watershed, and 81 percent in the upper watershed, or 66, 73, and 59 percent of the respective watershed areas were logged in a 42 year period, coinciding with the five largest floods in Redwood Creek.

In 1978, Redwood National Park was expanded from the narrow strip of old growth redwood along the lower one-third of mainstem Redwood Creek that was the original Park dating from 1968, and logging ended within the lower watershed that is protected as National and State Park lands (*i.e.*, the lower one-third of the watershed, and most of the Prairie Creek subwatershed are park lands, approximately 44 percent of the basin is Federal or state land). The expanded National Park contains much of the land that was extensively logged, and the Park is actively restoring its landscape by removing roads and engaging in restoration of its second growth forests.

Approximately 56 percent of the basin is private land, and commercial timber companies and small ranch and timber land owners continue to harvest timber on a rotational basis throughout the upper and middle watershed areas (approximately the upper two-thirds of the watershed are privately owned). Timber harvest practices of today are regulated by the California State Forest Practice Rules in general, and since 2006, lands owned by Green Diamond Resource Company have been managed under an Aquatic Habitat Conservation Plan (AHCP) (GDRC 2006). The AHCP contains many elements that will improve aquatic habitat over time, including an intensive geologic review program for unstable lands and a road decommissioning and upgrading program, both designed to reduce sediment inputs. However, many of the effects of intensive, historic timber harvest practices, such as reduced riparian shading, reduced large wood inputs to the streams and increased sediment inputs, continue to influence the habitat found today in the Redwood Creek basin.

Following post-European human settlement into the Redwood Creek floodplain and subsequent flooding in the town of Orick during the 1953, 1955, and 1964 high flows, the Corps constructed two earthen embankment flood control levees with riprap slope protection and associated infrastructure (*e.g.*, relief wells, flap gates, drains) on either side of the lower mainstem channel of Redwood Creek. The levees were constructed from 1966 to 1968, and confined Redwood Creek for 3.4 miles from the estuary upstream past the confluence of Prairie Creek. Prior to levee construction the Corps sent a report on their plans for construction of a flood control project in Redwood Creek and a request for comments from various Federal and state agencies. Both the U.S. Fish and Wildlife Service (USFWS) and California Department of Water Resources (DWR) expressed numerous concerns regarding the impacts of the proposed flood control project on fish (CDWR 1961; USFWS 1961), including effects on riparian vegetation and pool habitat.

The constructed flood control channel followed the existing Redwood Creek channel alignment, except sections were straightened and the last meander was cut-off and now forms the South Slough. The levees were extended into the estuary, approximately 2,000 feet beyond the preliminary designs (Ricks 1995), in a mostly theoretical attempt to flush sediment to the ocean during high flows, which has not worked, as sediment deposits in the estuary (NHE 2010a). Recent analysis (NHE 2010a) has determined that design flaws (*e.g.*, channel bed elevation set below grade and without enough channel gradient) of the original flood control project encourage sediment deposition rather than sediment transport. In addition, the design flow of 77,000 cfs, which was at the time of construction thought to be a return interval flood of 250 years, is now known to be a flood return interval flood of approximately 2,000 to 4,000 years. Considering the design flaws, the sediment transport rates in Redwood Creek, and habitat needs within the flood control project, the original flood control project design did not consider the geomorphic and ecological effects of the trapezoidal channel or the long-term maintenance (*i.e.*, riparian vegetation and gravel removal) needs. Levee construction has disconnected the channel from its floodplain, tributaries, sloughs and off-channel winter rearing habitat, prevents channel migration and creation of new habitat, and has greatly impacted estuarine function (Cannata *et al*. 2006) for Chinook salmon and steelhead.

In summary, these historic land uses have combined to produce simple instream habitat in much of the mainstem of Redwood Creek and its tributaries and estuary, with reduced availability of shelter, cover, shade, off-channel low velocity areas, pools, and an estuary that is much reduced in size, complexity and function from historic conditions. In contrast, much of the Prairie Creek subwatershed contains habitat in good condition, and provides valuable refugia habitat for listed salmonids.

Current Resources and Land Management

As noted above, about 44 percent of the basin is Federal or state land, with most of that being managed by Redwood National and State Parks (RNSP) with the goals of restoring and preserving the natural landscape. The remaining 56 percent of the basin is privately held, with most of the private land owned by commercial timber companies. The Green Diamond Resource Company is the largest private landowner in the basin and manages approximately 33,038 acres in the Redwood Creek watershed under their AHCP. The Redwood Creek Watershed Group (RCWG) has been active for about 10 years, has authored an integrated watershed strategy, promotes partnerships for habitat restoration and grant funding, and continues to meet quarterly to bring together various partners and efforts within the basin. The following are pertinent reports or plans for the Redwood Creek basin:

- NMFS Recovery Plan for SONCC Coho Salmon, Final (NMFS 2014);
- Redwood Creek Integrative Watershed Strategy (RCWG 2006);
- Redwood Creek Watershed Assessment (Cannata *et al.* 2006);
- Redwood National Park Land and Resource Management Plan (NPS 2000);
- Green Diamond Resource Company AHCP (GDRC 2006); and
- Recovery Strategy for California Coho Salmon (CDFG 2004).

Salmonid Viability and Watershed Conditions

The following indicators are rated as Poor through the CAP process for NC steelhead (see Redwood Creek CAP results for more details): LWD frequency, pool/riffle/flatwater ratio, shelter rating, tree diameter, mean sediment size, floodplain connectivity, turbidity, food productivity, estuary quality and extent, temperature, road density, streamside road density, staging pools, and quantity and distribution of spawning gravels, baseflow conditions, diversions, and abundance. Recovery strategies and actions will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the population area.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Redwood Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Velocity Refuge: Floodplain Connectivity

Lower Redwood Creek has been disconnected from its floodplain by the construction of flood control levees, which limit access to low gradient, off-channel rearing habitat (including tributaries, sloughs and wetlands) in the depositional area of mainstem Redwood Creek. In addition, roads limit floodplain connectivity in other low gradient stream sections, and much of the mainstem of Redwood Creek flows through a relatively narrow watershed with areas of inner gorges and steep slopes adjacent to the stream channel. The quality of floodplain habitat has also been reduced by conversion to agriculture adjacent to lower and middle sections of Redwood Creek. Velocity Refuge conditions have a rating of Poor for winter rearing juveniles.

Estuary: Quality and Extent

The Redwood Creek estuary was once a large and diverse habitat area that was essential for diversity and productivity of all Redwood Creek salmonid populations. Since 1968, flood control levees have bisected the estuary, which has disconnected the channel from sloughs, wetlands, tributaries and secondary channels, and has reduced the spatial area of the Redwood Creek estuary by over 50 percent (Ricks 1995). Currently, rearing habitat within the estuary and transition zone is simplified, with little cover, shelter, or access to off-channel areas. In addition, diversion culverts in the south levee limit access to the South Slough and Strawberry Creek, two of the remaining off-channel habitats in the estuarine area (which also include North Slough and Sand Cache Creek, which are blocked by sand deposition and reed canary grass much of the year). Specifically, the diversion culverts are closed during winter and spring, limiting access to habitat that provides shelter from high water velocities. However, the south levee culverts were constructed to increase fish access and water quality in the South Slough by creating a second point for water exchange in addition to the existing South Slough outlet channel into the estuary at the end of the south levee. If the culverts are left open during winter and early spring, river derived sediment would deposit in the South Slough further decreasing habitat access. Fish are still able to access the South Slough and Strawberry Creek during certain flows when the South Slough is connected to the most downstream portion of the estuary, or when the gates are open, as evidenced by a coho juvenile that was PIT tagged in Prairie Creek in October 2015 and found in Strawberry Creek in late December. RNSP is working to refine the operations of the south levee culverts to maximize fish access to off-channel areas and to minimize sediment deposition within the South Slough.

Low dissolved oxygen and warm water temperatures are also an issue in the estuary and South Slough, and the operation of the diversion culverts may aggravate already poor water quality. Since steelhead juveniles are dependent on extended estuarine rearing to provide growth that maximizes ocean survival, and to provide a diversity of out-migration timing which also increases ocean survival, the reductions in the quality and spatial area of the Redwood Creek estuary have an overall rating of Poor for smolts and summer rearing juveniles.

Water Quality: Temperature

High summer water temperature is a significant problem throughout most of the population area, especially in the middle and upper sections of mainstem Redwood Creek. Temperature conditions have a rating of Poor for summer rearing (juvenile) steelhead, summer adults, and smolts. Redwood Creek is listed as temperature impaired under section 303(d) of the Clean Water Act. High summer water temperatures in mainstem Redwood Creek, including the estuary, is one of the factors limiting salmonid production in the basin (Cannata *et al.* 2006; Sparkman 2006). Summer water temperature increases from the headwaters of Redwood Creek to the lower-middle section within Redwood National Park, then water temperatures gradually decrease as the river approaches the Pacific Ocean, as measured during a thermal infrared imaging flight during the summer of 2003. The middle section of Redwood Creek basin contains summer water temperatures with maximum weekly maximum temperatures (MWMT) ranging from 23 to 27°C. The Park has monitored water temperature of tributaries and mainstem Redwood Creek locations since the 1990s. In 2014, between May 22 and October 12, mainstem water temperature was measured upstream of the Tall Trees Grove within Redwood National Park. For the period July 1 through August 31, the average water temperature was 20.5°C, the maximum 24.1°C, and the minimum 17.9°C. The maximum weekly average temperature (MWAT) was 21.2°C, and the maximum weekly maximum temperature (MWMT) was 23.8°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 99.9 percent of the time (NPS 2015).

Madej *et al.* (2006) describes the middle section of Redwood Creek as the "hot zone," and notes that channel aggradation and widening, combined with the removal of large riparian conifers has played a role in increasing summer water temperatures. Sparkman (2012) has also monitored water temperatures at the upper smolt trap in the middle section of Redwood Creek since 2000. The average daily (24 hour period) stream temperature from March 25, 2014 to August 7, 2014 was 15.6 degrees C (or 60.1 degrees F) (95% CI = 14.9 – 16.3 degrees C), with daily averages ranging from 7.8 to 22.3 degrees C (46.0 – 72.1 degrees F). Median daily stream temperature during this time frame equaled 15.4 degrees C (or 59.7 degrees F). The maximum stream temperature for 2014 occurred on July 31, and equaled 26.3 degrees C (79.3 degrees F). Average stream temperature for the 2014 study year (truncated for equal comparisons with pervious study years) equaled 15.5 degrees C (59.9 degrees F). Average daily stream temperatures during the trapping periods did not statistically change over time (years).

Madej *et al.* (2006) also reports that the greatest thermal complexity occurs in lower Redwood Creek upstream of the leveed reach, within the area where Redwood Creek flows through a narrow watershed with inner gorges and steep slopes adjacent to the stream channel, within Redwood National Park. In this reach, Madej *et al*. (2006) measured with thermal infrared imaging many cool springs, seeps, side channels and tributaries. Lower Prairie Creek, other tributary streams and lower Redwood Creek, close to the ocean and within the temperate, summer fog belt, have lower temperatures relative to middle and upper Redwood Creek, but lower Redwood Creek is still warmer than the preferred temperature range of salmon and steelhead, causing stressful conditions for rearing juvenile salmonids. Water temperatures in Redwood Creek were monitored by Sparkman (2009) at the lower out migrant trap (river mile 4) during April through July for the period 2004 through 2008. During that time, the maximum weekly average temperature (MWAT) and MWMT ranged from 18.2 to 19.3°C and 21.1 to 22.7°C, respectively. In contrast, the optimum temperature range for rearing steelhead is 12 – 15°C.

Viability: Density, Abundance, and Spatial Structure

The condition of reduced abundance and density of summer steelhead adults has resulted in a rating of Poor for summer-run adults. In addition, the rating of fair for abundance and density of winter steelhead adults, summer rearing steelhead juveniles, and smolts results in a high stress to the population when combined with the poor rating for summer adults. The reduced abundance and density of the life stages described above reduces the viability of the Redwood Creek population as a whole.

Over the course of 35 years the greatest number of adult summer-run steelhead observed in the expanded survey reach of Redwood Creek was 59 adults in 2008 (NPS 2015). Due to their low abundance and the reduced depth and increased temperatures in holding pools essential to successful adult migration, summer-run steelhead are considered to be at High risk of being extirpated in Redwood Creek (Spence *et al.* 2008).

Sparkman (2011b) reported an age 1+ steelhead population estimate of 28,323 (24,546 – 32,101) in 2010, which was 24 percent less than the previous 10 year average abundance. The total number of age 1+ and age 2+ juveniles caught at both the lower Redwood Creek trap, and the Prairie Creek trap (i.e., total smolt population estimate for the basin) was 31,055 in 2011; 42,181 in 2012; 37,734 in 2013; and 60,719 in 2014 (M. Sparkman, CDFW, personal communication, 2015). Sparkman (2011b) has found that steelhead predominately out-migrate as age 1+, rather than age 2+, in mainstem Redwood Creek and has hypothesized that this is due to unfavorable rearing habitat conditions. Estimates of adult abundance have ranged from 148 winter adults based on spawner surveys (Ricker 2011a, 2011b) to 520 winter adults based on DIDSON counts (Metheny 2012) to a high of 1500 adults based on a more recent DIDSON count (M. Sparkman, CDFW, personal communication, 2015). All of the estimates of adult abundance are considerably lower than the combined winter and summer spawner target of 5,400 adults.

The severely limited numbers of adult summer steelhead reflects a greatly diminished level of abundance and diversity for this steelhead population. Both adults and juveniles are well distributed throughout most of the available habitat and passage and migration is rated as Very Good, but the diversity and abundance of the population is at risk as the adult summer steelhead life history trait has become quite rare, and the condition of the estuary and lower river negatively affects juvenile life history diversity and abundance.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediment conditions have an overall Poor rating for summer and winter rearing juveniles, winter and summer adult and egg lifestages. The Poor sediment rating for steelhead reflects the species' greater distribution and longer freshwater residency when compared with the Fair sediment rating described for Chinook salmon. Redwood Creek has naturally high sediment loads, which have been increased by past logging, landslides, and road building (Best 1995). Due to instream gravel mining for flood control in lower Redwood Creek and timber harvest activities in the rest of the basin, stream particle size has decreased in parts of the basin. Smaller particle sizes do not offer winter rearing juvenile steelhead the velocity refuge that is needed for shelter during higher winter flows. In addition, the increase in fine sediment decreases the productivity of food for summer-rearing juvenile steelhead, and also make redds more prone to scour during flood flows, negatively affecting eggs of both populations.

Water Quality: Turbidity or Toxicity

Turbidity conditions have a rating of Poor (measured as suspended sediment concentrations) for winter and summer adult and juvenile steelhead. However, these conditions have been recovering in recent years as the watershed heals from past logging and road building. Klein and Anderson (2011) documented shifts in the fine and course sediment budgets of Redwood Creek at the Orick gage. There is a decrease in annual bedload and suspended sediment loads when comparing the time period 1954 to 1974 to the time period 1975 to 2009. The higher sediment loads during the 1954 to 1974 period were caused by extensive logging and road building in a watershed with steep terrain and highly sheared and fractured rocks during a period of large storms and floods. Several researchers (Harden 1995; Kelsey *et al.* 1995; Madej and Curren 2009; Madej and Ozaki 2009) documented the substantial increase in hillslope sediment erosion and stream channel sediment deposition following the extensive legacy logging and road building during the 1950s to 1970s. Other researchers (Madej and Ozaki 1996) have also documented the extensive sediment deposition and its long-term migration through Redwood Creek's channel. In addition to increased turbidity levels, recent monitoring conducted in summer of 2010 by the RNSP shows low dissolved oxygen levels in the Redwood Creek estuary and South Slough.

Riparian Vegetation: Composition, Cover & Tree Diameter and Habitat Complexity: Percent Primary Pools and/or Pool/Riffle/Flatwater Ratios, and Large Wood and Shelter

Riparian Vegetation, large wood, and shelter conditions have an overall rating of Poor for the watershed processes, adults, smolts and summer rearing steelhead juveniles. The conversion of riparian areas to agriculture, the construction of flood control levees, and riparian vegetation removal for flood control in the leveed reach of Redwood Creek have altered riparian species composition within the basin. In addition, past harvest of coniferous trees within the riparian zone during logging has also altered riparian composition and the current riparian zones contain fewer coniferous trees, and in the case of Redwood Creek within the Orick valley, little riparian vegetation remains. Throughout much of the watershed riparian vegetation is dominated by hardwood species and young conifers, which will take many years to grow in order to provide functional, large pieces of instream wood. However, the 1968 original park boundaries protected much of the old growth streamside riparian forest in lower-middle mainstem Redwood Creek within the park.

The combination of an aggraded and widened channel, and lack of large wood supply has led to flatwater habitat (neither pool nor riffle), which has drastically reduced pool complexity. The increase in sediment yields and reductions in large wood inputs from streamside logging have reduced shelter habitat throughout the watershed, and removal of riparian vegetation for flood control purposes has decreased shelter and cover in lower Redwood Creek. However, Prairie Creek, which is mostly protected by park lands, contains more complex habitat with greater amounts of large wood and pools.

Sediment Transport: Road Density

Sediment Transport from road conditions have a rating of Poor for watershed processes. High road densities within the population area are primarily associated with past timber harvest and rural residences. Road densities range from 2 to 8 miles of road per square mile of land, with an average road density of 4.8 miles of road per square mile of area (Cannata *et al.* 2006). Although significant efforts continue to be made to upgrade and remove roads to reduce their sediment generating potential (e.g., road density within the park has decreased with the removal of 260 miles of old logging roads), road density remains high. However, the density is decreasing and recent estimates of suspended sediment and bedload passing the gage at Orick show reduced sediment transport in Redwood Creek (Klein and Anderson 2011).

Hydrology: Redd Scour

Hydrology: Redd scour conditions have a rating of Fair for eggs. Increased sediment yield and channel aggradation have likely increased the chances of redds being scoured by flood flows.

Hydrology: Baseflow and Passage Flows

Although flow is not regulated in the Redwood Creek watershed, reduced summer flow is primarily related to the increased demand for water for marijuana cultivation (S. Bauer, CDFW, personal communication, January 17, 2013) and for rural residences and agriculture. Marijuana cultivation has become locally abundant (Downie 2012), and the water diversion required to support these plants is placing a high demand on a limited supply of water (S. Bauer, CDFW, personal communication, January 17, 2013). Water diversions are most problematic in the middle portion of the watershed where aggraded and widened stream channels already cause sub-surface flow in the summer, and where summer water temperatures are highest. Lower streamflows reduce the quality of summer rearing habitats, resulting in warmer water temperatures and less available habitat. Hydrology conditions have a rating of Poor for summer rearing NC steelhead juveniles, as this lifestage is most exposed to the effects of impaired flows.

Very Good or Good Current Conditions

Very Good or Good rated conditions include passage and migration.. In addition, many aspects of landscape patterns (i.e., percent of watershed in timber harvest, agriculture and urbanized) were rated as very good currently, but based on past timber harvest practices (i.e., legacy timber harvest), landscape disturbance and watershed processes were rated as a high stress for this population. High road densities, past logging that has removed large conifers from riparian areas, and landslides that have been exacerbated by roads and timber harvest activities are the leading contributing factors to the stressful watershed processes condition. Large sediment inputs to Redwood Creek have caused channel aggradation, widening and a lack of deep pools within many channels. However, impervious surfaces and the extent of urban development within the population are favorably rated.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Redwood Creek CAP Results). Recovery strategies will likely focus on ameliorating Very High and High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Redwood Creek CAP Results.

Channel Modification

Channel modification is rated as a Very High threat for the smolt lifestage. Channel modification is also rated as a High threat for watershed processes and adults (summer and winter). The Redwood Creek estuary and lower mainstem river has been channelized and confined by levees for 3.4 miles, from the river mouth upstream to the beginning of the steeper stream channel that is naturally confined. As previously discussed, over 50 percent of the estuary has been lost through the construction of levees (Ricks 1995), and levees prevent access to important sloughs, wetlands and low gradient tributaries. The estuary, transition zone and lower river once contained complex summer and winter rearing habitat (Cannata *et al.* 2006) that was critical to successful completion of the freshwater juvenile lifestage, but very little of that historic function still exists. The potential function of the estuary (*e.g.*, growth, diversity, shelter, and ocean transition) becomes even more critical given the degraded rearing conditions found upstream in mainstem Redwood Creek and most of its tributaries. Both populations suffer from the decreased opportunity for increased juvenile growth and out-migration timing diversity that the current estuary and low gradient habitat provides.

Roads and Railroads

Roads are rated as a High threat for eggs, summer and winter rearing juveniles, and winter and summer adults. Roads are also rated as a High threat for watershed processes. As of 2006, Cannata *et al.* (2006) found that the Redwood Creek basin has an average of approximately 4.8 miles of road per square mile of area. Cannata *et al.* (2006) also found that the road density drops to 2.15 miles of road per square mile of area within the Prairie Creek and lower river sub-basins, and that private lands in the middle and upper portions of the Redwood Creek basin average over 8 miles of road per square mile of area. Fine sediment availability increases in basins with more than three miles of road per square mile of area (Cederholm *et al.* 1981). Considering the Very High road density, sediment yields from roads is currently a High threat, and Redwood Creek is listed as sediment impaired under section 303(d) of the Clean Water Act. NMFS expects that with ongoing upgrading and removal of roads by private landowners in the middle and upper basin, as well as the continuation of road removal in RNSP, that this threat will decrease over time. We note that as of 2016, RNSP removed approximately 260 miles of old logging roads from park lands within the basin, but the rate of road removal has decreased in recent years due to budget constraints.

Disease, Predation and Competition

This threat is rated as Very High for smolts primarily due to the degraded habitat conditions, lack of cover and high rates of juvenile predation found in the estuary, and predation of summer steelhead due to low quantity, and decreased quality of pool and cover habitat. Monitoring indicates that juveniles continue to enter the estuary during the summer months (Anderson 2005;

Sparkman 2010). Steelhead that remained in the estuary were larger than those that emigrated to the ocean (Anderson 2005; Sparkman 2011b) prior to the river mouth closure. This larger size can increase the probability of survival in the ocean (Reimers 1973; Bilton 1984; Beamer and Larsen 2004; Bond *et al.* 2008) provided these larger juveniles are able to survive summer and fall-rearing conditions and out-migrate to the ocean after the creek mouth re-opens in the fall. However, Anderson's data (Anderson 2011a; Anderson 2011d) show consistent and large declines in numbers of seined individuals and decreased juvenile population estimates within the estuary during summer and early fall sampling when the creek mouth is closed. Researchers believe that the dramatic decline in juvenile abundance within the closed estuary is due to predation rather than juveniles migrating back upstream (D. G. Anderson, D. G. Redwood National and State Parks, personal communication 11/30/2011; M. D. Sparkman, CDFW, personal communication, 2011).

Logging and Wood Harvesting

Logging is rated as a High threat to most steelhead lifestages. Although current timber harvest practices are more protective of salmonid habitat than previous practices, timber harvest continues to threaten salmonids in Redwood Creek by increasing sediment yield and by reducing streamside shading and potential large wood recruitment, affecting the quality and quantity of rearing and spawning habitat. Approximately half of the basin is in private ownership as industrial timberland, and commercial timber harvest continues in the middle and upper portions of Redwood Creek. Sediment yields have decreased in recent years (Klein and Anderson 2011), but poor instream habitat and riparian conditions persist throughout much of the basin (Madej *et al*. 2006), making Redwood Creek sensitive to ongoing threats from reductions in riparian shading and large wood recruitment that stem from timber harvest activities. In addition, large wood is often removed (i.e., "poached") from lower and middle Redwood Creek during the winter. It is then used for redwood carvings, sculptures, and for firewood. Removal of large wood from the channel exacerbates the problem of low levels of large wood recruitment from logged riparian areas.

Water Diversion and Impoundments

Water diversion and impoundments are rated as a High threat to summer rearing steelhead juveniles and summer adult steelhead. Aerial photographs of the Redwood Creek basin show numerous and large marijuana plantations, particularly in the Redwood Valley area in the middle portion of the basin. Marijuana cultivation and associated water diversion is placing a higher demand on a limited supply of water (S. Bauer, CDFW, personal communication, 1/17/13). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per season (Downie 2012). In addition, rural development in the Redwood

Valley area is consuming more water, both for domestic and agricultural uses (M. Sparkman, CDFW, personal communication, 12/2012), further reducing spring and summer flow conditions.

Mining

Instream gravel mining, mostly for flood control purposes, is rated as a High threat for steelhead summer and winter rearing juveniles, smolts, and summer adults. The leveed reach of Redwood Creek began aggrading with gravel immediately following levee construction. In an effort to combat this natural process and maintain the flood control project as designed, Humboldt County extracted gravel sporadically between 1968 and 2000, and annually between 2004 and 2010. Gravel removal results in simplified habitat, with reductions in pool availability, coarse surface particles and riparian vegetation, which are important for shelter and cover habitat. Currently, Humboldt County is proposing to mine large quantities of gravel due to the ongoing deposition of gravel in the flood control project reach. NHE (2010a; 2010b) have shown that the flood control project was not designed to transport gravel through the leveed reach; as a result, design deficiencies lead to gravel accumulation and the subsequent need to remove gravel to increase flood water conveyance capacity.

Fishing and Collecting

Fishing and Collecting is rated as a High threat to summer steelhead and a medium threat to adult winter steelhead due to an in-river sport fishery. The fishing season for Redwood Creek begins on the fourth Saturday in May and extends to March 31, subject to low flow closure from October 1 to January 31. Although wild, non-hatchery fish must be released after being caught (note that there is not a hatchery on Redwood Creek and any hatchery steelhead would be strays from a different population), there is a popular catch and release fishery for adult steelhead in Redwood Creek. Regulations do not currently protect these fish during the entire period of low flow conditions that occur coincident with their spawning migration. Anglers are allowed to target adult summer steelhead during low flow conditions in the summer, prior to October 1. Poor summer water quality contributes to the stress of catch and release, and likely results in increased hook-and-release mortalities (Clark and Gibbons 1991). Taylor and Barnhart also investigated summer steelhead hooking mortality and found that water temperature significantly influenced hooking mortality ($p = 0.002$) of summer steelhead. The study was done on the Mad and North Fork Trinity rivers from July-October 1995 and 1996 (1996). Winter adult steelhead are also subject to stress and mortality associated with the catch and release fishery since fishing is allowed up to March 31, a time period which is coincident with their spawning migration. Steelhead report card data available from CDFW (F. Bajjaliya, CDFW, personal communication, 2015) indicates that in 2012 (the only year with data available for Redwood Creek), there were 1,125 angling hours on Redwood Creek, with 175 wild steelhead released, 0 wild steelhead kept, 3 hatchery steelhead released and 11 hatchery steelhead kept.

Low or Medium Rated Threats

Low and Medium rated threats for steelhead include: residential and commercial development, severe weather patterns, livestock farming and ranching, agriculture, recreational areas and activities, fire, fuel management and fire suppression, and hatcheries and aquaculture.

Limiting Stresses, Lifestages, and Habitats

The current condition and threat analysis indicate that the summer adult, summer rearing juveniles and smolt lifestages of steelhead are limiting the viability of the steelhead population. The degraded condition of the estuary, impaired summer water temperatures, lack of habitat complexity, and in-river sport fishery are all factors limiting steelhead abundance. Diversity and variation in life history is also at risk due to the current conditions and threats facing adult summer steelhead and smolts. Adult summer steelhead are especially at risk due to Very Low population abundance, fishing pressure during summer periods of poor water quality, and lack of complex staging pools.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Redwood Creek populations is discussed below with more detailed and site-specific recovery actions provided in Redwood Creek CAP results, which provides the Implementation Schedule for these populations.

Enhance and Rehabilitate the Quality and Extent of the Redwood Creek Estuary and Improve Floodplain Connectivity

Efforts should be implemented to restore the quality and size of the estuary and to improve connection with the floodplain. Methods include: levee modification; reconnection and improvement of slough, wetland and tributary habitats; and enhancing cover and complexity by improving riparian vegetation quality and extent, and by adding structural elements to the channel. Steelhead in the Redwood Creek watershed are highly dependent on the estuary to gain size needed for ocean survival. The restoration of the estuary and re-connection of the floodplain would benefit several lifestages of NC steelhead, and contribute to improvements in life history diversity, ocean survival and adult abundance.

Reduce Water Temperature

Water temperatures throughout the majority of the watershed are stressful for summer rearing juveniles and summer adults. Increasing the amount of shade over the water will help in reducing high summer water temperatures. Improvements in riparian canopy should also contribute to proper riparian function and assist in filtering and preventing sediment from reaching the waterways from upslope. Additions of large wood and reductions in sediment yield will help create deep pools and provide thermal refuge. Investigating and limiting summer water diversions will increase flow and decrease summer water temperatures.

Habitat Complexity: Large Wood and Shelter

Take actions to increase shelter ratings, improve pool frequency and depths, increase pool volume, increase LWD abundance, and decrease the extent of flatwater habitats. Shelter, pool depths, and habitat complexity are lacking throughout the watershed and are a major stress for most lifestages. Actions include retaining conifers in riparian zones, adding LWD to channels, allowing riparian vegetation to grow in the leveed reach, reducing instream gravel removal, and minimizing removal of LWD from stream channels.

Reduce Sediment Inputs

Continuing to reduce sediment input is an important component to the Redwood Creek recovery strategy for NC steelhead. To increase habitat complexity and improve water quality, continue to remove or upgrade roads, reduce other sources of sediment input, and decrease instream gravel removal. Reducing sediment inputs will be especially effective at increasing habitat complexity and water quality when accomplished in conjunction with additions of large wood and other structural improvements to stream channels.

Logging and Riparian Management

As described above, shelter ratings and habitat complexity are lacking throughout the watershed and encouraging large wood recruitment to stream channels when managing riparian areas is an important component of increasing instream habitat complexity. Discourage the harvest of old-growth and large redwoods or other conifer trees within riparian areas. Large riparian conifers provide more value to the streams in terms of shading and LWD recruitment than smaller second growth trees.

Protect and Restore Habitat in Prairie Creek

Within the Redwood Creek watershed, the Prairie Creek subwatershed is unique in that it contains higher quality habitat than the rest of the basin. Prairie Creek is mostly contained within National and State Park land, but does contain some private land and roadways. It is critical to continue to protect (and restore where necessary) the higher quality habitat in Prairie Creek for all salmonid species within the basin.

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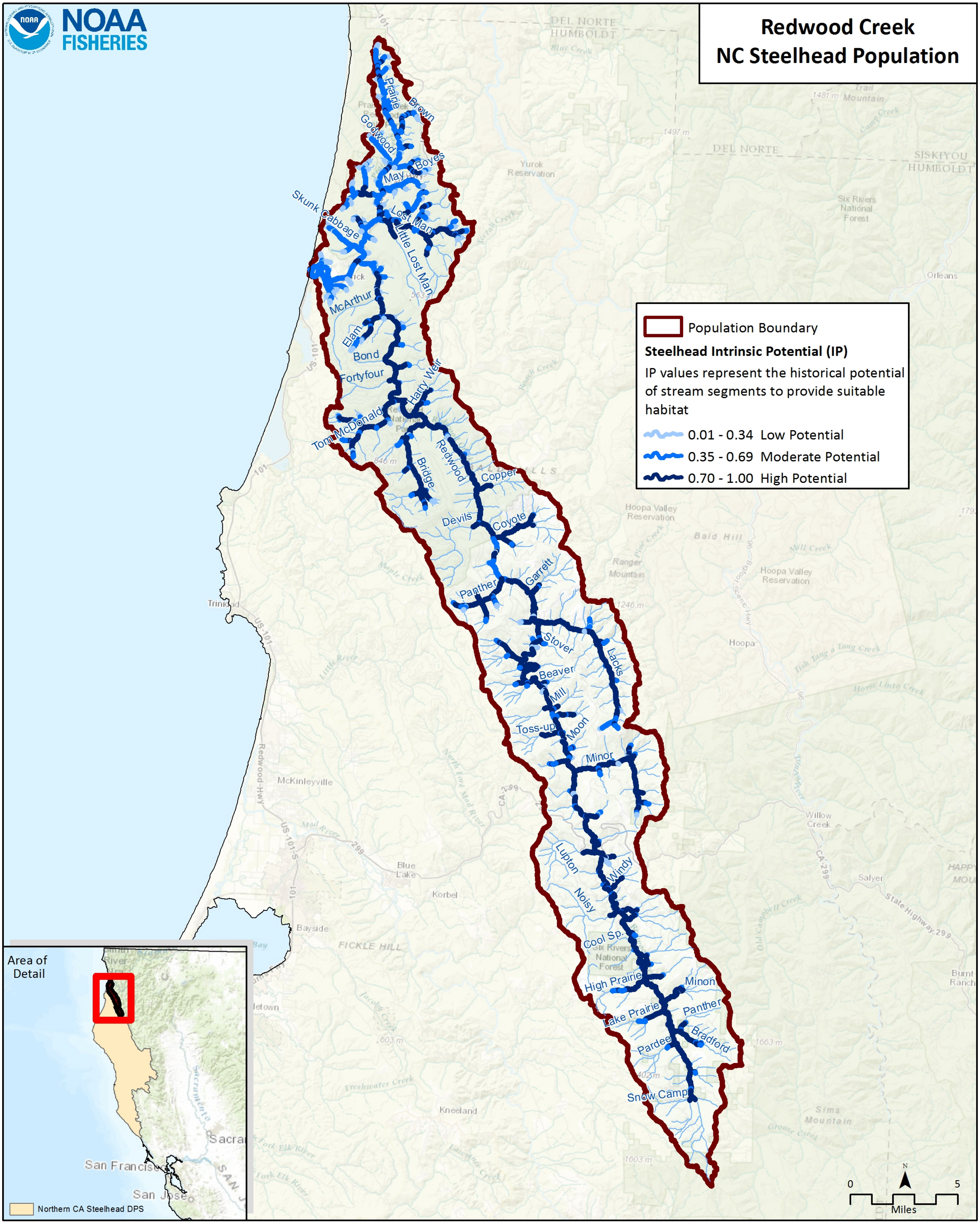
Redwood Creek
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Prairie
Brown
Godwood
Boyes
May
Skunk Cabbage
Lost Man
Little Lost Man
McArthur
Elam
Bond
Fortyfour
Harry Weir
Tom McDonald
Redwood
Bridge
Copper
Devils
Coyote
Garrett
Panther
Stover
Lacks
Beaver
Mill
Toss-up
Moon
Minor
Lupton
Windy
Noisy
Cool Sp.
High Prairie
Minon
Lake Prairie
Panther
Bradford
Pardee
Snow Camp
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
Miles
0
5
N

NC Steelhead Redwood Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<4% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<1% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	31% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.19	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.81% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39.41% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	28.69	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	75	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		7-20	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score = 58	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score = 58	Fair

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	16.04% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	80% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	28.69	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<4% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<1% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	62% of streams/ IP-Km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	31% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.19	Good
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	Poor

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35	Factor Score = 83	
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score = 67	Fair
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP km	Poor
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.81% of IP-km	Very Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	54% of streams/ IP-Km (>70% average stream canopy)	Fair
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39.41% Class 5 & 6 across IP-km	Poor
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	28.69	Poor
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	80% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Good
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	75	Good
Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17	Fair

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2-0.6	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90%of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<4% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<1% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	31% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.19	Good

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.81% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39.41% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	28.69	Poor
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	80% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	75	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score = 58	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	<50% IP-Km (>6 and <14 C)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	75	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.09% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.46% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	13.4% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	8.26 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	7.62 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	<50% of streams/ IP-Km (>20% staging pool frequency)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score = 67	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score = 67	Fair

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.81% of IP-km	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	16.04% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	80% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Good
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	28.69	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
		Size	Viability	Abundance					<301	Poor

NC Steelhead Redwood Creek CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium
2	Channel Modification	High	Medium	Very High	Very High	Very High	Medium	High	Very High
3	Disease, Predation and Competition	Low		High	Medium	Very High	Medium	Medium	High
4	Fire, Fuel Management and Fire Suppression	Low		Medium	Medium	Medium	Low	Medium	Medium
5	Fishing and Collecting	Medium		Low		Low		High	Medium
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
8	Logging and Wood Harvesting	High	Medium	High	High	Medium	High	High	High
9	Mining	Medium	Low	High	High	High	Medium	High	High
10	Recreational Areas and Activities	Low	Low	Medium	Medium	Medium	Low	Medium	Medium
11	Residential and Commercial Development	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	High	High	High	Medium	High	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	High	Medium	Medium	Medium	High	High

Redwood Creek (Lower and Upper), Northern California Steelhead (Northern Coastal/North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NnCRd-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
NnCRd-NCSW-1.1.1.1	Action Step	Estuary	Assess feasibility of modifying levees by working with landowners and stakeholders, and prioritize sections of levees for setback or removal.	1	3	USACE, NGO, County, landowners, NPS, NMFS	
NnCRd-NCSW-1.1.1.2	Action Step	Estuary	Remove setbacks and levees, guided by assessment.	1	10	USACE, NGO, County, landowners, NPS, NMFS	
NnCRd-NCSW-1.1.1.3	Action Step	Estuary	Modify operation of diversion culverts in South Slough to increase access to estuarine and tributary habitat.	1	1	NPS	
NnCRd-NCSW-1.1.1.4	Action Step	Estuary	Increase passage into South Slough, Strawberry Creek, Sand Cache Creek, North Slough (estuarine tributaries).	1	2	NPS, NGO, landowners, County	
NnCRd-NCSW-1.1.2	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics				
NnCRd-NCSW-1.1.2.1	Action Step	Estuary	Assess tidally influenced habitat and develop plan to restore tidal channels.	1	3	USACE, NGO, County, landowners, NPS, NMFS	
NnCRd-NCSW-1.1.2.2	Action Step	Estuary	Restore tidal wetlands and tidal channels, guided by plan.	1	10	USACE, NGO, County, landowners, NPS, NMFS	
NnCRd-NCSW-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**				
NnCRd-NCSW-1.2.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
NnCRd-NCSW-1.2.1.1	Action Step	Estuary	Assess design flaws of the Redwood Creek Flood Control Project that encourage sediment deposition and amend criteria used to assess flood control project.	1	2	USACE	
NnCRd-NCSW-1.2.1.2	Action Step	Estuary	Modify flood control project to address design flaws and amend criteria.	1	10	USACE	
NnCRd-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
NnCRd-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	1	3	NPS, NGO, CDFW, NMFS, County, landowners	
NnCRd-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Re-connect the floodplain, guided by assessment.	1	10	NPS, NGO, CDFW, NMFS, County, landowners	Lower river, Redwood Valley, Prairie Creek, and other low gradient areas.
NnCRd-NCSW-2.1.2	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge				
NnCRd-NCSW-2.1.2.1	Action Step	Floodplain Connectivity	Assess watershed and prioritize potential refugia habitat sites.	1	3	NPS, NGO, CDFW, NMFS, landowners	
NnCRd-NCSW-2.1.2.2	Action Step	Floodplain Connectivity	Implement projects that create refugia habitats, guided by assessment.	1	10	NPS, NGO, CDFW, NMFS, landowners	
NnCRd-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-5.1.1	Recovery Action	Passage	Assess physical passage barriers				
NnCRd-NCSW-5.1.1.1	Action Step	Passage	Modify or remove physical passage barriers where they exist, such as within occupied tributaries to Redwood Creek and Prairie Creek	2	1	NPS	
NnCRd-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools and low velocity shelter habitat				
NnCRd-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a plan to restore habitat complexity, reduce water temperatures and provide shelter and cover.	2	2	NPS, CDFW, NGO, landowners, NMFS	
NnCRd-NCSW-6.1.1.2	Action Step	Habitat Complexity	Restore habitat complexity in identified areas, by using additions of large wood or creation of low velocity habitat.	2	5	NPS, CDFW, NGO, landowners, NMFS	
NnCRd-NCSW-6.1.1.3	Action Step	Habitat Complexity	Implement actions to increase the frequency of pool habitats	2	10	NPS, CDFW, NGO, landowners, NMFS	
NnCRd-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency and shade in riparian areas				

Redwood Creek (Lower and Upper), Northern California Steelhead (Northern Coastal/North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NnCRd-NCSW-6.1.2.1	Action Step	Habitat Complexity	Manage riparian vegetation to promote late seral characteristics while maintaining bank stability and existing shade.	3	10	NPS. CalFire, CDFW, landowners	
NnCRd-NCSW-6.1.3	Recovery Action	Habitat Complexity	Improve instream channel complexity				
NnCRd-NCSW-6.1.3.1	Action Step	Habitat Complexity	Reduce instream vegetation and gravel removal in lower Redwood Creek.	1	1	USACE, County, NMFS	
NnCRd-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**				
NnCRd-NCSW-6.2.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
NnCRd-NCSW-6.2.1.1	Action Step	Habitat Complexity	Reduce removal of instream large wood (i.e., wood poaching)	2	10	NPS, CDFW, County	
NnCRd-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian condition				
NnCRd-NCSW-7.1.1.1	Action Step	Riparian	Remove non-native species that inhibit fish passage (e.g., invasive aquatic vegetation, such as reed canary grass) and establishment of native riparian vegetation.	2	1	NPS, CDFW, NGO, landowners	
NnCRd-NCSW-7.1.1.2	Action Step	Riparian	Plant native riparian species to prevent the recolonization of invasive aquatic vegetation.	2	20	NPS, CDFW, NGO, landowners	
NnCRd-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-8.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment				
NnCRd-NCSW-8.1.1.1	Action Step	Sediment	Assess potentially future large inputs of fine sediments (e.g., landslides, failed culverts at imminent risk into occupied habitat).	2	2	NPS, NGO, CDFW, landowners	
NnCRd-NCSW-8.1.1.2	Action Step	Sediment	Reduce fine sediment input from areas that are currently large sediment producers and are at imminent risk of sediment entering occupied habitat	2	10	NPS, NGO, CDFW, landowners	
NnCRd-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
NnCRd-NCSW-10.1.1.1	Action Step	Water Quality	Manage riparian vegetation to promote late seral characteristics while maintaining bank stability and existing shade.	3	10	NPS. CalFire, CDFW, landowners	
NnCRd-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address disease or predation**				
NnCRd-NCSW-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
NnCRd-NCSW-14.1.1.1	Action Step	Disease/ Predation/ Competition	Retain riparian vegetation within flood control project to increase cover habitat and reduce predation	1	10	USACE, County, NMFS	
NnCRd-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Evaluate effects of New Zealand Mud Snails	3	10	NPS, CDFW, NMFS	
NnCRd-NCSW-14.1.1.3	Action Step	Disease/ Predation/ Competition	Take action to reduce NZMS based on evaluation	3	10	NPS, CDFW, NMFS	
NnCRd-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**				
NnCRd-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
NnCRd-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Evaluate effects of in-river fishery for steelhead.	2	2	CDFW	

Redwood Creek (Lower and Upper), Northern California Steelhead (Northern Coastal/North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NnCRd-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Based on evaluation, modify fishing regulations	2	2	CDFW	
NnCRd-NCSW-18.1	**Objective**	**Livestock**	**Address the inadequacy of existing regulatory mechanisms**				
NnCRd-NCSW-18.1.1	Recovery Action	Livestock	Prevent and minimize alterations to riparian species composition and structure				
NnCRd-NCSW-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from area.	2	2	NPS, landowners, NGO, RCD, NRCS	
NnCRd-NCSW-18.1.1.2	Action Step	Livestock	Install fence, guided by plan.	2	10	NPS, landowners, NGO, RCD, NRCS	
NnCRd-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
NnCRd-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
NnCRd-NCSW-19.1.1.1	Action Step	Logging	Develop plan that identifies areas in need of more shade and large wood recruitment that currently support steelhead and describes timber management methods that will increase shade and wood recruitment overtime.	3	2	CalFire, NPS, CDFW	
NnCRd-NCSW-19.1.1.2	Action Step	Logging	Manage forests in identified areas to increase shade and large wood recruitment, guided by plan.	3	10	CalFire, NPS, CDFW	
NnCRd-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NnCRd-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and decommission roads that are at high risk of imminent failure, guided by assessment.	2	10	NPS, Private Landowners	
NnCRd-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission moderate to low risk roads, guided by assessment.	3	10	NPS, Private Landowners	
NnCRd-NCSW-23.1.1.3	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	10	NPS, Private Landowners	
NnCRd-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	10	NPS, Private Landowners	
NnCRd-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NnCRd-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
NnCRd-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Conduct a study to document extent of water diversions and the effects of these diversions on salmonids, which includes recommendations for amount of diversion that would not limit recovery.	2	5	CDFW, RWQCB, SWRCB	
NnCRd-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Reduce diversions to level that would not limit recovery of salmonids.	2	15	CDFW, RWQCB, SWRCB	

South Fork Eel Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 19,000 adults
- Current Intrinsic Potential: 951.8 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: N/A

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Quantitative abundance and distribution estimates of South Fork Eel River steelhead are sparse. Steelhead spawners were counted in the South Fork Eel River at the Benbow Dam from 1938 through 1975, with a high of 25,032 counted in 1942 and a low of 1,847 in 1975, the last year of operation. It should be noted that Benbow Dam occurs approximately halfway up the South Fork Eel River, and therefore the number of fish counted underestimates the true run size of the population. In its description of the South Fork Eel River, a 1965 California Fish and Wildlife Plan stated that the watershed contained a total of 428 miles of steelhead habitat and supported an annual spawning run of 34,000 steelhead (CDFG 1965).

Modern steelhead data is available as mainly indirect, or ancillary, observations collected while focused on surveys for other species (*e.g.*, SONCC coho salmon). Juvenile steelhead are known to be well-distributed throughout most tributaries in the population area, but recent adult steelhead monitoring data is lacking. Based on surveys conducted by CDFW in the South Fork Eel targeting SONCC coho salmon, small to moderate numbers of adult steelhead have been observed since 2010. It is important to note that most steelhead data is biased low as salmon surveys often do not extend throughout the adult migration and spawning season of steelhead. Steelhead distribution in the South Fork Eel River is widespread, with more streams occupied in the Western and Northern sub-basins due to more suitable stream temperatures and gradients (CDFG 2014).

History of Land Use

Settlement of the region began in the 1850s and the first 100 years of activity had lasting effects on the forests, rivers, and fish populations of the region. Settlement of the South Fork Eel did not experience rapid growth until the 1900s due its remoteness. Canneries were located along the Eel River, and during the 1860s to 1900s it was common to have a commercial salmon catch numbering in the hundreds of thousands of fish in the lower Eel River. In 1904, 345,800 salmon and steelhead were harvested by fishing in the lower portions of the river (Lufkin 1996).

Early timber operations attempted to convert natural timber lands to grazing lands, with little success because the landscape and climate favored the natural vegetation regime. Only when accessibility was well established in the 1900s to 1910s did large-scale timber operations develop to a significant extent (PALCO 2006). The use of log trucks and ground-based tractor yarding began in the 1940s and initiated a period of extensive road building and skid trail use. Railroad and early truck haul routes were commonly located near, or sometimes even within the stream channels. The combination of the early railroad and pre-1970s logging practices had a profound impact on the watercourses in the area (PALCO 2006).

Erosion from poorly constructed roads in the highly erosive Franciscan geology has contributed to increased sediment loads in the region's rivers, leaving streams shallower, warmer, and more prone to flooding (Raphael 1974; Bodin *et al.* 1982). Sediment mobilized from the 1955 and 1964 floods choked the channels with sediment. As a result, many streams have become wider and shallower (USEPA 1999). Levees were built along the lower Eel River to prevent flooding of urban areas, which significantly reduced the size of the estuary and disconnected the floodplain from the main channel.

Sacramento pikeminnow were introduced to Lake Pillsbury in 1980 (CDFG 1997), and have since colonized all accessible reaches of the Eel River watershed. This predator thrives in the warmer waters of the South Fork Eel River resulting from channel aggradation and degraded riparian forests.

Current Resources and Land Management

Most of the South Fork Eel population area is privately owned and is predominantly in timber production. Marijuana cultivation is another land use as well as rural development in some locales. The Humboldt Redwood Company (HRC) Habitat Conservation Plan (HCP) covers approximately 200,000 acres of forestland. The goals of the HRC HCP include trending towards properly functioning aquatic conditions and reducing sediment input by upgrading 1,500 miles of roads (HRC 2012). The Mendocino Redwood Company (MRC) currently has a draft HCP which covers two of the key western tributaries to the South Fork Eel: Hollow Tree Creek and Jack of Hearts Creek. There are several active watershed groups in the area: the Eel River Watershed Improvement Group, Friends of the Eel River, Salmonid Restoration Federation, and the Eel River Recovery Project. The following are pertinent reports or plans for the Lower Eel and South Fork Eel Rivers:

- South Fork Eel River Basin Report (CDFW 2014)
- Recovery Strategy for California Coho Salmon (CDFG 2004);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997);
- Lower Eel River Watershed Assessment (CDFG 2010);
- South Fork Eel Watershed Analysis (Fuller *et al.* 1996);
- Humboldt Redwood Company HCP (HRC 2012);
- Mendocino Redwood Company Draft HCP (MRC 2012);
- HRC Watershed Analyses for: Lower Eel/Eel Delta and Upper Eel (PALCO 2006); and
- South Fork Eel and Lower Eel Total Maximum Daily Loads (USEPA 1999; 2007).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for steelhead (see South Fork Eel CAP results): estuary quality and extent, LWD frequency, staging pools, passage at mouth or confluence, tree diameter, turbidity, gravel quality, shelter rating, baseflow conditions, diversions, floodplain connectivity, temperature, mainstem temperature (summer steelhead), road density, stream-side road density, and reduced abundance (summer steelhead). Recovery strategies and actions will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions with the population area.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The South Fork Eel River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of all Eel River salmon populations. The Eel River estuary is severely impaired because of past diking, and filling of tidal wetlands for agriculture and flood protection. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Water Quality: Temperature

High water temperature is a significant problem throughout most of the population area. These impaired water temperature conditions are most stressful for lifestages rearing in the mainstem of the South Fork Eel River during the summer. Temperature conditions are rated Fair for summer rearing juveniles and smolts and poor for summer adults, which hold in the mainstem where temperatures are higher than in tributaries.

Riparian Vegetation: Composition, Canopy Cover & Tree Diameter

NMFS rated riparian species composition conditions as Fair for watershed processes, and rated tree diameter as poor for adults and both summer- and winter-rearing juveniles. Percent staging pools and pool/riffle/flatwater ratio are both rated Fair. Due to past harvest of coniferous trees and insufficient replanting, the species composition has become less dominated by conifers. As such, the trees in the riparian area are dominated by young conifers of small diameter and non-conifer species, both of which do not provide functional pieces of large wood to the stream.

Habitat Complexity: Large Wood, Shelter, Pools, and Vstar & Velocity Refuge: Floodplain Connectivity

Surveys conducted by CDFW (SEC 2012) indicate that shelter ratings are poor throughout the population area for all life stages, with only six percent of the IP-km habitat meeting desired levels. Large wood frequency is rated fair for winter adults and summer-rearing juveniles due to altered species composition as described above. Pool indicators (% primary pools, pool/riffle/flatwater ratio, or both) are rated Fair for winter adults, summer- and winter-rearing juveniles, and staging pools are rated Fair for summer adults. The combination of a large sediment supply and reduced riparian function (leading to reduced wood recruitment) has led to a preponderance of flatwater habitats (neither pool nor riffle), which has greatly reduced pool complexity for summer- and winter-rearing juveniles. These habitat complexity features are impaired due to a deficit of large wood (which causes the river to form pools) and a large supply of sediment. Sediment has filled pools, as reflected by the Fair rating for Vstar. The 1955 and 1964 floods deposited large amounts of sediment, which reduced pool depths and simplified channels.

In many areas, the floodplain is disconnected from the channel, so winter adults and winter-rearing juveniles have insufficient refuge from high winter flows and can be washed downstream or expend too much energy to hold in place, potentially affecting growth and ultimately reducing survival.

Sediment: Embeddedness, Gravel Quality, and Distribution of Spawning Gravels

Egg and pre-smolt lifestage conditions are rated Fair for embeddedness, which occurs when sediment fills the interstitial spaces between gravel and impairs the ability of gravel to support developing eggs and shelter fry. Embedded gravels also do not afford pre-smolts the refuge from high winter flows, and have reduced food productivity which affects pre-smolts and smolts. Gravel quality for eggs is rated poor because much of it is too small, resulting in potential reduced survival due to impaired conditions. The Eel River has one of the highest natural loads of sediment in the country (Brown and Ritter 1971) and the larger mainstem segments reflect the high sediment loads as gravels are highly embedded.

Sediment Transport: Road Density

High road densities within the population area are primarily associated with past timber harvest and rural residences. Sediment transport conditions from road densities have a rating of Poor for watershed processes, because for every square mile of land there are 3.9 miles of road. Although significant efforts to upgrade or decommission roads to reduce their sediment generating potential are ongoing, road density remains high.

Viability: Density, Abundance, and Spatial Structure

The abundance of adults and density of summer juveniles are rated fair. Both steelhead adults and juveniles are well distributed throughout most of the available habitat, but the diversity of the population is at risk as the adult summer steelhead life history trait may be extirpated in the population area.

Hydrology: Baseflow

The reduced summer flow in the mainstem Eel River and South Fork Eel River are primarily related to the increased demand for water for marijuana cultivation (S. Bauer, CDFW, personal communication, January 17, 2013). Marijuana cultivation has become locally abundant, and the water diversion required to support these plants is placing a high demand on a limited supply of water (S. Bauer, CDFW, personal communication, January 17, 2013). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per season (Downie 2012). Reduced summer flows can also be partly attributed to increased evapotranspiration rates resulting from replacement of old-growth forests with younger forests (Perry 2007). These lower flows reduce the quality of summer rearing habitats, resulting in water quality conditions favoring pikeminnow (a predator). Baseflow is rated poor for summer-rearing juveniles and summer adults, which suffer from reduced baseflow during summer and fall.

Instantaneous flow conditions, which are impaired when a diversion occurs and potentially dewaters an area, are rated fair for summer-rearing juveniles and summer adults.

Passage/Migration: Mouth or Confluence, Number, Condition and Magnitude of Diversions & Hydrology: Passage Flows

Adult winter-run steelhead tend to enter the Eel River beginning in December, when flows are generally higher due to winter rains, leading to a good rating for passage flows. Passage flows and the magnitude of diversions are also rated good for smolts because they leave the system in the spring, before diversions impact the system in the summer and fall. Passage flows at the mouth of the Eel River and the confluence of the South Fork and mainstem Eel River are rated fair for summer adults due to diversions. The high magnitude of diversions in the population area result in a poor passage flow rating for summer-rearing juveniles and summer adults, as these life stages are present in the summer and fall during the entire diversion season.

Water Quality: Turbidity and Toxicity

Turbidity levels high enough to affect salmon health (>25 NTU) were documented in several tributaries of the Van Duzen River, which is a nearby tributary of the Eel River with a similar land use history, from 2000 to 2003 (Harkins 2004). Turbidity is rated Poor for juveniles, smolts, and adults, likely reflecting high sediment loads in the basin. Toxicity is rated Fair for juveniles, smolts, and adults. Wastewater treatment facilities affect the Lower Eel downstream of the Van Duzen (CDFG 2010), which is a migratory corridor for individuals en route to the ocean or estuary. The Loleta wastewater treatment facility accepts both municipal wastewater and wastewater from the Humboldt Creamery and the Loleta Cheese Factory. This facility discharges into percolation/evaporation ponds on the Eel River; these ponds overflow into the Eel River in the winter (CDFG 2010). Marijuana cultivators use rodenticides and herbicides, and these toxic materials can enter the river.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Lower Eel and South Fork Eel CAP results). Recovery strategies focus on ameliorating High or Very High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Lower Eel and South Fork Eel CAP results.

Water Diversion and Impoundments

Water diversion and impoundments are rated as a Very High threat to summer rearing juveniles, and a High threat to summer adults, smolts, and watershed processes, leading to an overall rating of High. The reason for the diversions is primarily to support marijuana cultivation and rural residences, as described above under Hydrology: Baseflow.

Channel Modification

Channel modification is rated as a High stress for summer rearing juvenile and smolts, leading to an overall high threat. The Eel River estuary and mainstem has been significantly channelized by dikes and levees and subsequent filling for ranching or livestock purposes. Approximately 60 percent of the estuary has been lost through the construction of levees and dikes and CDFG (2010) estimates that only 10 percent of salt marsh habitats remain today. The estuary once supported a high degree of estuarine habitat and rearing potential, but very little of that historic function still exists. The function of the estuary (*e.g.*, rearing, refugia, ocean transition) is very important given the degraded habitat conditions and predation and competition from non-native Sacramento pikeminnow occurring upstream of the estuary in the mainstem river. Juveniles and smolts rearing in or transitioning through mainstem and estuarine habitat will continue to be threatened by the degraded conditions in these habitats. Both juveniles and smolts suffer from the lost opportunity for increased growth, which would improve their survival at ocean entry.

Disease, Predation and Competition

Disease, predation and competition is rated as a High threat to juveniles and smolts primarily due to the presence of the Sacramento pikeminnow. Pikeminnow have become ubiquitous throughout the Eel River and its tributaries and is a known predator of salmonids. This invasive species has large impacts in areas with impaired habitat conditions, because the altered conditions favor production of the pikeminnow over indigenous salmonids. Summer rearing juveniles and smolts are most vulnerable as they compete with pikeminnow for food and territory.

Fishing and Collecting

Fishing and collecting is rated a High threat to summer adults. Although this species must be released after being caught, there is a popular catch-and-release fishery targeting them which attracts hundreds, if not thousands, of anglers every season. Regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration. Currently, sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second, and in the South Fork Eel River when flow is less than 340 cfs at the gauging station at Miranda. However, the low flow season does not begin until October 1st of each year and ends January 31st which allows anglers to target steelhead staging in low flow conditions throughout September and during the peak spawning season. Poor water quality during low flows contributes to the stress and likely results in increased hook-and-release mortalities (Clark and

Gibbons 1991). Steelhead Report Card data collected by CDFW indicates consistent and perhaps increasing fishing pressure on steelhead in the South Fork Eel River, with a high of 895 wild fish released in the most recent year with data available (2012). Due to the isolated nature of the watershed, poaching likely occurs but the extent of which is unknown.

NMFS has determined that the effects of Pacific coast ocean salmon fisheries conducted under the Pacific Fishery Management Plan and U.S. Fraser Panel salmon fisheries in Northern Puget Sound conducted under the Pacific Salmon Treaty are "not likely to adversely affect" listed steelhead species because steelhead are only occasionally encountered and it would be impossible to measure or detect potential effects of the proposed action on those species (NMFS 2001).

Roads and Railroads

Road density is high throughout the South Fork Eel River basin. Many of these roads are unpaved and leach sediment into the river and its tributaries. This fact, combined with the substantial rise in marijuana cultivation and future rural residential development in the South Fork Eel River results in a High threat rating for roads.

Severe Weather Patterns

With future climate change the frequency, intensity and duration of droughts in the region could all increase which could have a considerable negative effect on the distribution and abundance of steelhead in the South Fork Eel River drainage. This threat is especially high for summer rearing juveniles and summer adults, which are already subjected to warm summer water temperatures and reduced habitat availability (low flow) in much of the interior South Fork Eel River drainage.

Limiting Stresses, Lifestages, and Habitats

The diminished abundance of the summer rearing juvenile lifestage is likely limiting the population. The impaired water temperatures in the mainstem segments, lack of habitat complexity, reduced summer flows, and vulnerability to predation by Sacramento pikeminnow are all factors contributing to limiting the summer rearing lifestage. Diversity and variation in life history is also at risk due to the stresses and threats facing summer adult steelhead. Summer adult steelhead are subject to fishing pressure during periods of poor water quality, limited dispersal ability due to shallow riffles, reduced flows, and a lack of complex staging pools.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions. The recovery strategy for the Lower Eel and South Fork Eel populations are discussed below with more detailed and site-specific recovery actions provided in the Implementation Schedule (see Lower Eel and South Fork Eel CAP results).

Enhance and Rehabilitate the Quality and Extent of the Eel River Estuary

Efforts should be implemented to restore the quality and size of the estuary including: levee setbacks, tidal slough reclamation, tide gate replacement, increased connectivity between estuary and tributaries entering estuary (e.g., Salt River, Francis, Russ, Williams Creeks), and enhanced cover and complexity by adding structures. CDFG (2010) suggests that over 50 percent of the estuary has been reclaimed for other purposes. All of the salmonid species present in the Eel River watershed highly depend on the estuary, and its restoration would benefit several lifestages and contribute to improvements in the diversity of life history traits present.

Improve Habitat Complexity and LWD Recruitment

Take actions to increase shelter ratings, improve pool depths, increase pool volume, increase LWD abundance, and decrease the extent of flatwater habitats which are the result of habitat simplification. Shelter, pool depths, and habitat complexity are lacking throughout the population area and are a major stress for most lifestages. Actions should be taken immediately to bolster the simplified habitat conditions common throughout the population area.

Investigate and Address Water Diversion and Groundwater Extraction

Flows during late summer and early fall are getting lower each year, even following rather wet springs in recent years. The demand and use of water is contributing to lower summer flows which is exacerbating stagnancy in the mainstem reaches. This lack of flow combined with an increased input of nutrients is resulting in more prolific algae growth throughout the area, which is reducing the dissolved oxygen content of the water and exacerbating the stress of poor water quality conditions.

Improve Canopy Cover and Reduce Water Temperature

Water temperatures throughout the majority of the larger segments of the mainstem South Fork Eel River are approaching lethal levels and therefore making juvenile summer rearing problematic and stressful. Increasing the amount of instream shade will help in reducing high summer water temperatures. Improvements in riparian vegetation should also contribute to proper riparian function and assist in filtering and preventing sediment from reaching the waterways from upslope.

Reduce Abundance of Sacramento Pikeminnow

Explore how best to reduce the abundance of the Sacramento pikeminnow population. Provide increased refugia habitat for salmonids through the creation of cool and complex habitats, and make habitat less suitable for pikeminnow by managing to reduce water temperature.

Improve Fishing Regulations

The low flow season on the Eel River does not start until October 1st, which allows anglers to target steelhead during stressful conditions in September. The low flow closures should start earlier in the year (e.g. September 1st as regulated in the Mad River) and be extended through the duration of the spawning season. Due to the isolated nature of the watershed, poaching likely occurs and should be closely monitored.

Focus Initial Efforts on Restoring Key Tributaries

There are several key tributaries to the South Fork Eel River population that provide excellent spawning and rearing conditions. Efforts should be focused on these key tributaries in the early phases of recovery plan implementation, to ensure that conditions are improved in areas that are occupied and functional. Tributaries such as Hollow Tree Creek, Indian Creek, Sproul Creek, Salmon Creek, and Redwood Creek should be targeted for implementation of recovery actions as soon as feasible to ensure that key areas are bolstered.

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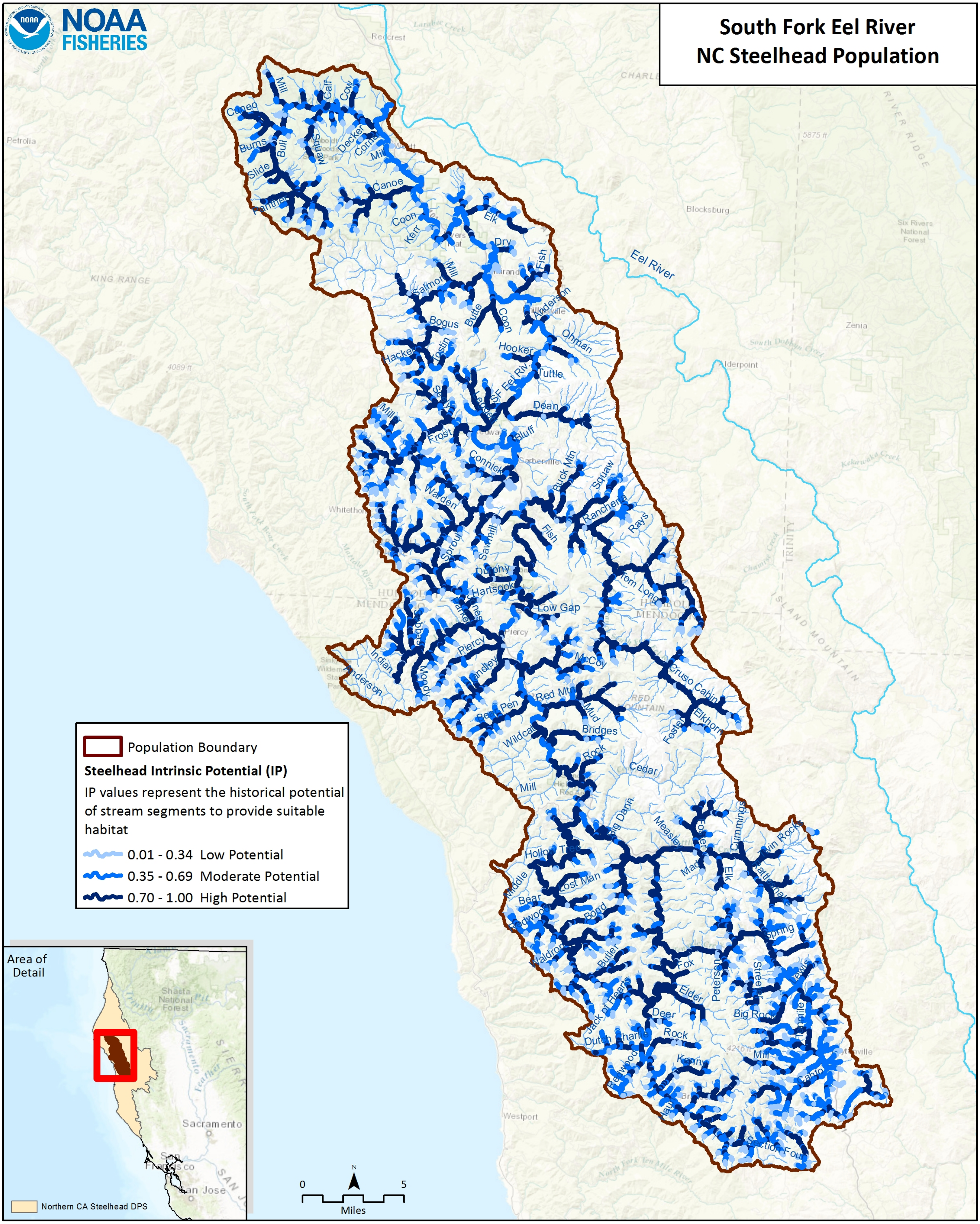
South Fork Eel River
NC Steelhead Population



NC Steelhead South Fork Eel River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	68% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	6% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.27	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.38% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39.31% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	67.75	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	22.43	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	22.86	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	55% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	67.75	Very Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	50% of streams/ IP-km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	68% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	6% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.27	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	Poor

					Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35	Factor Score >75	
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP-km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.38% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	54% of streams/ IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39.31% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	67.75	Very Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	55% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	22.43	Good

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	58.57% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.7 - 1.5 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	68% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.27	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.38% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39.31% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	67.75	Very Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	55% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	22.43	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	6% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	22.43	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance to produce low risk spawner density per Spence (2008)	Good

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.17% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.06% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	15.5	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	2% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	3.9 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	3.73 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	50% of streams/ IP-km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	6% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.38% of IP-km	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	22.86	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	55% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	67.75	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT)	50 to 74% mainstem IP km (<20 C MWMT)	75 to 89% mainstem IP km (<20 C MWMT)	>90% mainstem IP km (<20 C MWMT)	<50% mainstem IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
		Size	Viability	Abundance	<1 Spawner per IP-km (Reference Spence)	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		<1 Spawner per IP-km (Reference Spence)	Poor

NC Steelhead South Fork Eel River CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Low	Low	Medium	Low	Medium	Medium	Medium	Medium
2	Channel Modification	Low	Low	High	Medium	High	Low	Medium	High
3	Disease, Predation and Competition	Low	Low	High	Medium	Medium	Medium	Medium	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Medium		Low		High	Medium
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Low	Low	Medium	Medium	Medium	Low	Medium	Medium
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium
9	Mining	Low	Medium	Medium	Low	Low	Medium	Medium	Medium
10	Recreational Areas and Activities	Medium	Low	Medium	Low	Low	Medium	Medium	Medium
11	Residential and Commercial Development	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Low	Medium	High	Medium	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	Medium	Medium	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Very High	Low	Medium	High	High	High

South Fork Eel River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SFEeR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
SFEeR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Develop a plan to recreate off-channel ponds, alcoves and backwater habitat.	1	5	CDFW, Tribes, NMFS	
SFEeR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows, guided by assessment.	1	10	CDFW	
SFEeR-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
SFEeR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
SFEeR-NCSW-3.1.1.1	Action Step	Hydrology	Ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB	
SFEeR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
SFEeR-NCSW-5.1.1.1	Action Step	Passage	Inventory migration and flow barriers and develop plan to restore passage.	2	5	CDFW	
SFEeR-NCSW-5.1.1.2	Action Step	Passage	Restore passage, guided by plan.	2	10	CDFW	
SFEeR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
SFEeR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	CDFW, Tribes, NMFS	
SFEeR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Add structure, guided by plan.	2	10	CDFW, Tribes, NMFS	
SFEeR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Plant conifers guided by plan.	2	20	CDFW, Tribes, NMFS	
SFEeR-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**				
SFEeR-NCSW-6.2.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
SFEeR-NCSW-6.2.1.1	Action Step	Habitat Complexity	Reduce removal of instream large wood (i.e., wood poaching)	2		NPS, CDFW, County	
SFEeR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
SFEeR-NCSW-7.1.1.1	Action Step	Riparian	Remove invasive species that inhibit establishment of native riparian vegetation.	3	5	CDFW	
SFEeR-NCSW-7.1.1.2	Action Step	Riparian	Plant native riparian species in denuded areas.	2	20	CDFW	
SFEeR-NCSW-7.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
SFEeR-NCSW-7.2.1	Recovery Action	Riparian	Improve riparian conditions				
SFEeR-NCSW-7.2.1.1	Action Step	Riparian	Reduce detrimental environmental impacts of conversion of TPZ land to other uses.	2	10	NMFS, Calfire, BOF	
SFEeR-NCSW-7.2.1.2	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	10	NMFS, Calfire, BOF	
SFEeR-NCSW-7.2.1.3	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	10	Calfire, BOF	
SFEeR-NCSW-7.2.1.4	Action Step	Riparian	Work to ensure effects of activities on converted areas are minimized.	2	10	NMFS, Calfire, BOF	

South Fork Eel River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SFEeR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-10.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants				
SFEeR-NCSW-10.1.1.1	Action Step	Water Quality	Reduce intensity of remote outdoor agriculture's nutrient and chemical inputs and improve practices to prevent pollutants from reaching watercourses.	2	10	CDFW	
SFEeR-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
SFEeR-NCSW-14.1.1.1	Action Step	Disease/ Predation/ Competition	Assess feasibility and benefits of various methods to eradicate or suppress Sacramento pikeminnow, including genetic technology methods (e.g., deleterious genes).	3	5	CDFW	
SFEeR-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Take measures to eradicate or suppress fish species using genetic technology or other methods identified as feasible.	3	25	CDFW	
SFEeR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
SFEeR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
SFEeR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	5	CDFW	
SFEeR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult salmonids by increasing law enforcement.	2	5	CDFW	
SFEeR-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Change the low flow season under applicable fishing regulations for the main stem Eel River to start on September 1.	1	5	CDFW	
SFEeR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
SFEeR-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	3	20	CDFW, NRCS, Private Landowners, RCD	
SFEeR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
SFEeR-NCSW-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription to improve size and density of conifers.	3	5	CalFire	
SFEeR-NCSW-19.1.1.2	Action Step	Logging	Thin, or release conifers guided by prescription.	3	10	CalFire, CDFW	
SFEeR-NCSW-19.1.1.3	Action Step	Logging	Develop plan that identifies areas in need of more shade that currently support steelhead and describes timber management methods that will increase shade over time.	3	5	CDFW	
SFEeR-NCSW-19.1.1.4	Action Step	Logging	Work with Calfire and CDFW through the timber harvest permitting process, to manage forests in identified areas to increase shade, guided by plan.	3	10	CalFire, CDFW, NMFS	
SFEeR-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				

South Fork Eel River, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SFEeR-NCSW-21.1.1.1	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about steelhead and how to minimize impacts.	3	5		
SFEeR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
SFEeR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	3	10	CDFW	
SFEeR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	10	CalFire, CDFW, Counties	
SFEeR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	10	CalFire, CDFW, Counties, Private Landowners	
SFEeR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	3	10	CalFire, CDFW, Counties, Private Landowners	
SFEeR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.	3	10	CDFW	
SFEeR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	20	CalFire, CDFW, Counties, Private Landowners	
SFEeR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	20	CalFire, NMFS, Private Landowners	
SFEeR-NCSW-23.1.1.8	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	20	CalFire, CDFW, Counties, Private Landowners	
SFEeR-NCSW-23.1.1.9	Action Step	Roads/Railroads	Conduct habitat surveys to monitor change in key habitat variables	3	5	CDFW, NMFS, Private Landowners	
SFEeR-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SFEeR-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SFEeR-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow.	2	10	RWQCB	
SFEeR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flow.	2	10	RWQCB	

NC Steelhead DPS Rapid Assessment Profile:
Northern Coastal Diversity Stratum Populations

Guthrie Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 53 -108 adults
- Current Intrinsic Potential: 9.2 IP-km

Oil Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 62-125 adults
- Current Intrinsic Potential: 10.6 IP-km

McNutt Gulch

- Role within DPS: Dependent Population
- Spawner Abundance Target: 66-134 adults
- Current Intrinsic Potential: 11.3 IP-km

Spanish Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 9-21 adults
- Current Intrinsic Potential: 1.9 IP-km

Big Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 21-44 adults
- Current Intrinsic Potential: 3.8 IP-km

Big Flat Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 33-69 adults
- Current Intrinsic Potential: 5.9 IP-km

Shipman Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 12-26 adults
- Current Intrinsic Potential: 2.3 IP-km

Telegraph Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 30-62 adults
- Current Intrinsic Potential: 5.3 IP-km

Jackass Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 39-81 adults
- Current Intrinsic Potential: 6.9 IP-km

Abundance and Distribution

Prior to 1991, there were no data available to describe the abundance and distribution of steelhead within McNutt Gulch, Guthrie, Oil, Jackass, Spanish, Big, Big Flat, Shipman, and Telegraph creeks for steelhead. No spawner or redd surveys have been conducted in this stratum. However, based on habitat and population surveys conducted by BLM and CDFW between 1999 and 2006, steelhead are well distributed throughout the selected populations. Population surveys in Spanish, Big, Big Flat, and Shipman creeks indicate there are good numbers of juvenile steelhead (Engle 2005; Colombano 2012; USBLM unpublished data).

Table 1 shows estimated juvenile steelhead abundance in 1999 and 2000 for Spanish Creek. Engle (2005) found multiple age classes of juvenile steelhead in Spanish Creek, and estimated age 0+ mean density to be 0.48 fish/m^2 SE =0.06; 0.42 fish/m^2 SE=0.05; and 0.28 fish/m^2 SE=0.03 in pools, runs and riffles respectively. Engle (2005) estimated age 1+ steelhead densities to be 0.23 fish/m2 SE=0.02; 0.16 fish/m^2 SE=0.03 and 0.14 fish/m^2 SE=0.02; in moderate, low and high gradient reaches respectively.

Table 1: Estimated Summer and Fall Abundance and summer survival of juvenile steelhead in Spanish Creek (Engle 2005).

	Spanish Creek		
	Summer Abundance Est.	Fall Abundance Est.	Est. Summer Survival Rate
1999	1783.4 CI +/-541.5	1537.6 CI +/-368.9	86.2
2000	5782.5 CI +/-618.2	4310.0 CI +/-827.5	74.5

Figure 1 shows the estimated abundance of juvenile steelhead in Big Flat and Spanish creeks from 2003 to 2006. Figure 2 shows estimated densities of juvenile steelhead in these creeks as well. Densities and abundance estimates for Shipman and Big creeks show similar trends observed in Spanish and Big Flat (BLM unpublished data).

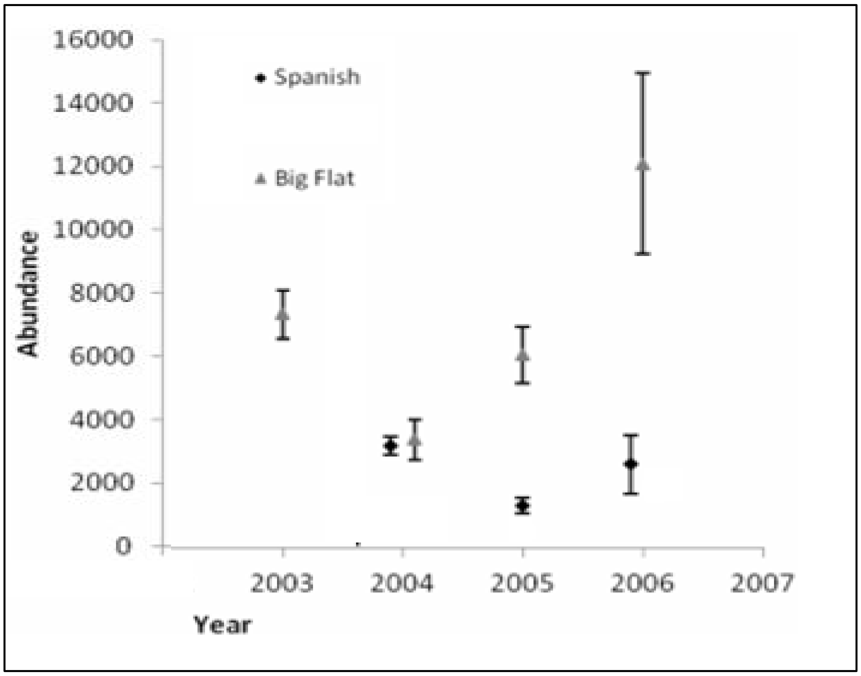


Figure 1: As modified from Figure 31 in Colombano (2012). Estimated juvenile steelhead abundance in Spanish and Big Flat creeks from 2003 to 2006. The error bars are 95% confidence intervals.

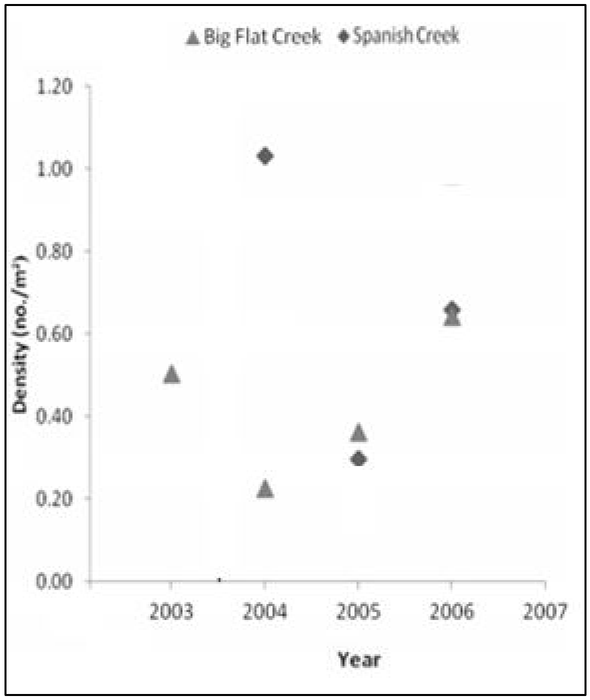


Figure 2: As modified from Figure 35 in Colombano (2012). The density (number per m²) of juvenile steelhead trout in the study reaches of Spanish and Big Flat creeks, King Range National Conservation Area.

Limited fishery surveys have been conducted in Jackass and Oil creeks. CDFW surveyed Jackass Creek in 1999 and observed juvenile steelhead (young-of-year and older age classes) from the stream banks, with about 10 to 50 fish per pool. CDFW surveyed Oil Creek in 1999 and conducted single pass electrofishing in 32 habitat units capturing 120 juvenile steelhead representing multiple age classes.

There was no data for McNutt Gulch, Telegraph, and Guthrie creeks to characterize steelhead abundance and distribution in these watersheds.

History of Land Use, Land Management and Current Resources

Historic land use and management in the NC Stratum varies between watersheds. The Northern Coastal stratum can be divided into two areas: 1) the BLM's King Range National Conservation Area (KRNCA) (Spanish, Big, Big Flat, and Shipman creeks), and 2) watersheds outside the KRNCA (McNutt Gulch, Guthrie, Oil and Jackass creeks).

The KRNCA is regarded as pristine landscape, because the KRNCA was not settled as densely as other parts of the North Coast region. Consequently, the KRNCA was never dominated by a single industry and the organized timber industry largely passed it by, due to the lack of redwood forests and the relative inaccessibility (USBLM 2004). Currently, management within the KRNCA is limited to a few roads, isolated homesteads, camping and hiking trails (USBLM 2004).

Relative to the watersheds in the KRNCA, the remaining watersheds have undergone more intensive management. Settlers first entered the Shelter Cove area *(i.e.,* Telegraph Creek) to the south (Machi 1984), and the vicinity of present day Petrolia along the Mattole River to the north (Clark 1983; Eastman and Praetzellis 1995) in the early 1850s. Many early ranchers raised cattle as well as sheep for mutton and wool to supply the Gold Rush market. Locally around Shelter Cove, fishing became a major economic enterprise by the 1880s, particularly for salmon. Around the turn of the century, a tanbark industry emerged with one center at Briceland, another at Bear Harbor (Jackass Creek) in the Sinkyone Wilderness, and a third at the mouth of the Mattole River. Bark was stripped from tanoak trees and used to produce tannins for processing leather. However, the tanbark industry dwindled by 1940 after a cheaper and faster method of tanning leather was invented. At this time, the timber market transitioned from tanbark to Douglas-fir. In the 1940s and 1950s, huge areas of Douglas-fir were cut to meet the market demand. The timber industry harvested these areas using mechanized equipment, which enabled them to harvest in the most remote areas that were previously inaccessible. Once the timber was gone, some ranchers maintained the grass that grew in place of the trees by burning. The pastures generally did not last long, and grew back mostly as tanoak forest.

This intensive and accelerated harvesting of Douglas-fir left an extensive legacy on the landscape. A study in 1968 showed that coverage by hardwoods, mainly tanoak, had increased significantly as a result of timber harvest practices (Oswald 1968). In addition, erosion from poorly-constructed logging roads and the lack of reforestation contributed to greatly increased sediment loads in the region's rivers, leaving streams shallower, warmer, and more prone to flooding (Raphael 1974; Bodin *et al.* 1982). This condition proved disastrous in the winters of 1955 and 1964, when heavy rains caused immense flooding along the entire North Coast. Combined with water diversions and an increasingly active fishing industry, the eroded character of cut-over lands also had devastating effects on local anadromous fish populations, with salmon and steelhead runs shrinking to roughly one-third their historic sizes by the 1960s.

Since the 60s the watersheds outside the KRNCA have undergone different types of land management. The Jackass creek watershed was repeatedly logged by Georgia Pacific Timber Company through the 1980s and early 1990s until the Sinkyone Intertribal Wilderness Council (SIWC) purchased 4,000 acres of land, which includes the Jackass Creek watershed. McNutt Gulch, Oil and Guthrie creeks have since been logged periodically but have been largely subdivided into parcels of rural residential or cattle ranches.

Diversity Stratum Population and Habitat Conditions

Impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on the conditions is abated. The following discussion focuses on those conditions that rate as a Poor or Fair, thus having the greatest impact on steelhead life history stages (see "Northern Coastal Diversity Stratum" Rapid Assessment Results). These are: Impaired Streamflow, Impaired Migration, Habitat Complexity: Large Wood and Shelter, Sediment: Gravel Quality and Distribution of Spawning Gravels, Viability: Density, Abundance, and Spatial Structure. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and functioning watershed processes.

Hydrology: Baseflow and Passage Flows

Hydrology: Baseflow and Passage Flows is rated as Fair for summer rearing juveniles. The State Water Resource Control Board's Division of Water Rights manages an electronic database (eWRIMS) that tracks information on Statements of Water Diversion and Use which have been filed by water diverters, as well as registrations, certificates, and water right permits and licenses that have been issued. Within the NC Stratum, there are three diversions identified in EWRIMS. These diversions are located in Guthrie, Oil, and Telegraph creeks. These are generally small but are year round, with peak demand occurring the summer low flow months. NMFS (2012) found the largest of three diversions, in Telegraph Creek, to have insignificant effects on steelhead because of mandatory bypass flows. However, the remaining two diversions are riparian diversions and have no set bypass flows and may continue to divert water during periods of low flow. There is also potential for undocumented riparian diversions or illegal diversions to occur throughout the stratum. Even small water diversions during the summer months have the potential to reduce the growth and survival of juvenile steelhead (Harvey *et al*. 2006). Therefore, given the existing water diversions and the potential for undocumented water diversions or illegal water diversions in McNutt Gulch, Guthrie, Oil, and Telegraph creeks; Hydrology: Baseflow and Passage Flows for summer rearing juveniles is rated as Fair for this population.

Passage/Migration: Mouth or Confluence and Physical Barriers

Passage and Migration are rated as Fair for summer rearing juveniles and adults. There are two known barriers for fish passage within the NC stratum, both of them are in Telegraph Creek. These barriers include a dam and a triple culvert road crossing, both are located 1.1 miles upstream from the Pacific Ocean and block 4,900 feet of potential steelhead habitat. Both of these barriers are in the process of being modified to facilitate fish passage (NMFS 2012). However, the dam in Telegraph Creek has been previously modified with the goal of providing fish passage for all lifestages of steelhead (NMFS 2012). Until the dam and road crossing successfully provide passage for all lifestages of steelhead, passage and migration will continue to be a problem for this population.

Habitat Complexity: Large Wood and Shelter

Habitat Complexity: Large Wood and Shelter is rated Poor for Adult, Summer Rearing Juvenile, Winter Rearing Juvenile lifestages; and Fair for the smolt lifestage. CDFW conducted habitat inventories in McNutt Gulch, Oil, Telegraph, and Jackass creeks. CDFW reported Poor shelter ratings for these watersheds; specifically, 11, 25, 23.9 and 27 respectively. Poor to Fair LWD ratings were also documented in these watersheds. Insufficient data exists to calculate shelter ratings for the KRNCA watersheds. However, Colombano (2012) found abundant LWD concentrated in wood jams in Spanish and Big Flat creeks. LWD is also abundant in Shipman and Big creeks (A.J. Donnell, USBLM, personal communication, 2011; D. Wilson, NMFS, personal observation, 2010) (see Photo 1). Despite good LWD loading in the KRNCA watersheds, the remaining watersheds comprise the majority of habitat within the Stratum. Therefore, low shelter ratings and low LWD loading in McNutt Gulch, Oil, Telegraph, and Jackass creeks affect Adult, Summer Rearing Juvenile, and Winter Rearing Juvenile lifestages across this strata.

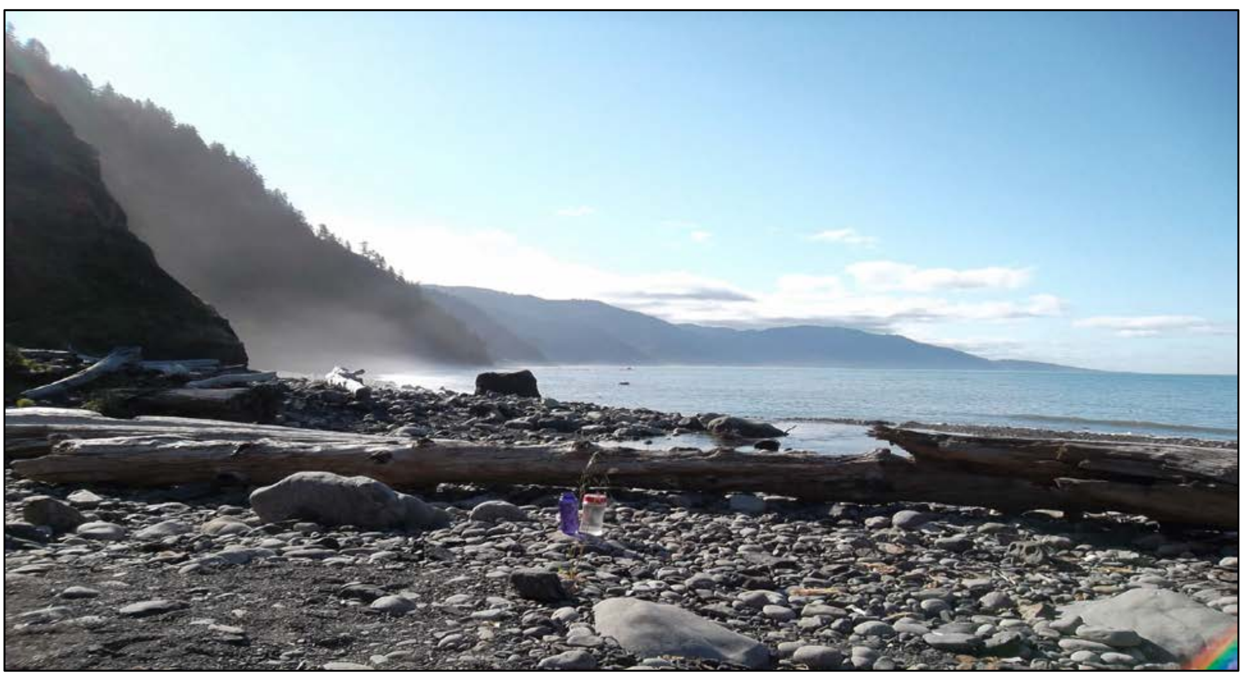


Photo 1: Abundant LWD at the mouth of Shipman creek in King Range Conservation Area. May 29, 2010. Photo Courtesy: Dan Wilson, NMFS.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediment: Gravel Quality and Distribution of Spawning Gravels is rated as Fair for Summer Rearing Juveniles and Egg lifestages. CDFW conducted habitat inventories in McNutt Gulch, Oil, and Telegraph creeks and found Poor and Fair embeddedness ratings. Spawning gravel quality and quantity was also found to be in Poor or Fair condition in these watersheds. NMFS (2012) found Guthrie Creek to have Poor embeddedness ratings and Poor spawning gravels as a result of excessive cattle grazing and timber harvest. CDFW also conducted a habitat inventory in Jackass Creek and found the watersheds to have a good embeddedness rating as well as good spawning substrate. There is insufficient data on the KRNCA watersheds to determine the level of embeddedness or spawning gravel quality and quantity; however, these attributes were presumed to be in good condition because of the pristine nature of these streams A.J. Donnell BLM, (A.J. Donnell, USBLM, personal communication, 2011; D. Wilson, NMFS, personal observation, 2010). McNutt Gulch, Oil, Telegraph, and Guthrie creeks amount to 63% of the habitat within and NC stratum and have either Poor to Fair ratings for substrate embeddedness and spawning gravel quality and quantity.

Viability: Density, Abundance and Spatial Structure

Viability: Density, Abundance and Spatial Structure is rated as Fair for Adult and Smolt lifestages. Engle (2005) and Colombano (2012) found densities of summer rearing juvenile steelhead in Big Flat and Spanish creeks (Figure 1, Figure 2) to be below the standard for a fully stocked stream (*i.e.*, 1 fish per square meter) (Nickelson *et al.* 1992; Solazzi *et al.* 2000). However, the low densities for these creeks likely have a minor effect on the population partly because the summer survival of juvenile steelhead within the watersheds is very good (*i.e.*, between 74.2% and 86.2%) (See Table 1). These densities and summer survival rates are assumed to be a general representation of conditions in Big and Shipman creeks as well. CDFW also noted similar observations of densities in Jackass and Oil creeks. Given that summer survival of juvenile steelhead is high for these watersheds, increases in steelhead abundance would most likely be a result of improving habitat that would directly improve spawning success, egg to fry survival, winter survival, or smolt to adult survival.

No information exists to estimate the density, abundance, and diversity of steelhead in McNutt Gulch, Guthrie, and Telegraph creeks. However, these watersheds represent a significant portion of the NC stratum. Therefore, to better understand the extent of the conditions caused by reduced density, abundance, and diversity, it is necessary to implement recovery actions that inform and address these attributes.

Threats

Threats are proximate activities or processes that have caused, are causing, or may cause the condition. The following discussion focuses on those threats that rate as a primary or secondary concern (see "Northern Coastal Diversity Stratum" Rapid Assessment Results). Recovery strategies will focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in "Northern Coastal Diversity Stratum" Rapid Assessment Results.

Livestock Farming and Ranching

The coastal areas of these watersheds are frequently used for cattle grazing especially in the watersheds north of the Mattole River (*i.e.*, McNutt Gulch, Oil, and Guthrie creeks). Grazing and trampling by livestock typically causes bank destabilization, loss of riparian habitat, sedimentation and increased embeddedness, and consequent changes in benthic prey, turbidity, and loss of stream connectivity. Because this area is particularly prone to bank destabilization and erosion, grazing is especially harmful to stream habitat and steelhead. Fifty-four percent of the habitat within the NC stratum is currently grazed. Therefore, Livestock Farming and Ranching is considered as a threat contributing to the conditions Sediment: Gravel Quality and Distribution of Spawning Gravels

Logging and Wood Harvesting

Within the NC Stratum logging and wood harvesting is mostly likely to occur in McNutt Gulch, Oil, Guthrie, and Telegraph creeks. However, the impacts from historic logging are present in Jackass Creek. Most land, except for Jackass Creek, is likely on a 30 to 50 year rotation with 25 to 35 percent of the area being harvested based on CalFire's Forest Practices GIS data (NMFS 2012). Poor riparian conditions in these watersheds have been attributed to past and present timber harvest. The lack of mature riparian forest along streams and LWD instreams reflect the outcome of early harvest practices with no riparian buffers. Although some areas of the watershed have likely recovered some of their riparian structure and function, the cessation of logging in riparian areas was too recent for many areas to progress to the late seral stage. Also, because the area is already prone to erosion and high turbidity, additional sediment inputs associated with timber harvest can have major consequences for steelhead in this population. The overall threat associated with logging and wood harvesting is considered as a threat contributing to the following conditions: Riparian Vegetation: Composition, and Cover and Tree Diameter and Habitat Complexity: Large Wood and Shelter.

Recreational Areas and Activities

The coastal area extending from Jackass Creek to the Mattole River is called California's Lost Coast and is popular destination for hikers and backpackers. This area is primarily owned by California State Parks and the BLM. The Lost Coast trail intersects Jackass Creek, Telegraph Creek, Shipman Creek, Big Flat Creek, Spanish Creek, and Big Creek. Backpackers often camp alongside these creeks because the streams supply the only source of freshwater along the 38-

mile trail. Campfires are a common occurrence along these streams. Thus, smaller pieces of LWD are commonly extracted from riparian areas in the lower segments of these streams and used for fire wood. USBLM estimates that current usage of the Lost Coast trail to be 153,731-190,109 visitor days annually (USBLM 2004). USBLM estimates a modest increase in visitor days over the next decade. Over time the removal of LWD, albeit smaller pieces, from riparian areas may have significant effects on the population in this Stratum. Therefore, Recreational Areas and Activities are considered a threat contributing to the conditions of; Habitat Complexity: Large Wood and Shelter.

Roads and Railroads

Except for the KRNCA watersheds, the NC Stratum is predominantly private timberland and contains networks of private, unpaved logging roads. The overall density of roads in the McNutt Gulch, Guthrie, and Oil creek watersheds is very high (>3 miles road per square mile of watershed). These roads are built on unstable soils and are prone to erosion and washouts. Of particular concern are road-stream crossings, which typically contribute the most to sediment loading. Sediment that originates from roads accretes instream channels and leads to high levels of turbidity. The shallowing and widening of stream channels, cementation of gravels, and suspended sediment loads lead to decreased survival of eggs and decreased growth and survival of juveniles. Adults are impacted by the lack of suitable spawning habitat due to excessive fine sediment entering watercourses from these roads. Therefore, Roads and Railroads are considered a threat contributing to the conditions of; Sediment: Gravel Quality and Distribution of Spawning Gravels.

Water Diversion and Impoundments

Please see discussion above on conditions from "Hydrology: Baseflow and Passage Flows."

Fishing and Collecting

Fishing is prohibited throughout the NC Stratum. Nevertheless, as noted earlier there is relatively high public access to KRNCA watersheds and Jackass Creek. There is evidence of fishing in these streams (*i.e.*, fishing line in brush) and anecdotal reports of fishing in these remote areas (D. Wilson, NMFS, personal observation, May 29, 2010). Because these areas are very remote, enforcement of state fishing regulations and the Endangered Species Act is rare. In addition, signage is nonexistent to inform the public that fishing in these watersheds is prohibited. Since each watershed is only capable of supporting small numbers of adult steelhead, harvesting steelhead from these watersheds can have a significant impact on the NC Stratum population. Therefore, Fishing and Collecting is considered a threat contributing to the condition; Viability: Density, Abundance and Spatial Structure.

Limiting Conditions, Lifestages, and Habitats

The summer juvenile steelhead lifestage is the most limited in the NC Stratum, followed by adults, winter rearing, smolts and eggs. Large Wood and Shelter, Summer Flows and Passage, and Gravel Quality and Distribution of Spawning Gravels are the conditions most limiting summer juvenile rearing as well as the other lifestages. Implementing recovery actions that reduce or eliminate these conditions are necessary to the recovery of steelhead within the NC Stratum. High priority areas for restoration include McNutt Gulch, Oil Creek, Guthrie Creek, Jackass Creek, and Telegraph Creek. Spanish Creek, Big Creek, Big Flat Creek, and Shipman Creek are likely strongholds for the NC Stratum but only represent 25% of the recovery target for these selected populations.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating conditions and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in this Stratum are discussed below with more detailed and site-specific recovery actions provided in "Northern Coastal Diversity Stratum" Rapid Assessment.

Increase LWD Recruitment and Abundance, and Improve Shelter Ratings

Pool shelter levels and LWD abundance are Poor in most watersheds in the Stratum. Strategically placing channel forming features in high priority reaches in McNutt Gulch, Oil Creek, Guthrie Creek, Jackass Creek, and Telegraph Creek will increase summer rearing habitat capacity. Additionally, establishing appropriate size riparian buffer zones throughout the watershed will increase cover and promote natural LWD recruitment.

Abandon Unnecessary Roads and Hydrologically Disconnect Existing Roads

Decommission, improving, and maintaining roads will reduce sediment pollution, erosion, and improve spawning substrate and reduce embeddedness levels in the streambed. Strategically removing or rehabilitating roads in McNutt Gulch, Oil Creek, Guthrie Creek, and Jackass Creek is an important action to improve egg survival and increase summer growth of juvenile steelhead.

Maximize Offstream Water Storage

Protecting spring and summer hydrologic conditions will be essential for the recovery of steelhead in the Stratum. Lower surface flows will likely limited the current extent of summer steelhead rearing within the Stratum. Monitoring and gaging of streamflows in McNutt Gulch, Oil Creek, Guthrie Creek, Telegraph Creek, and Jackass Creek is needed to assess the potential condition juvenile steelhead undergo during the summer months. Where possible, existing diversions should be minimized using minimum bypass flows or replaced with offstream storage.

Increase Public Awareness in KRNCA and Sinkyone Wilderness

The general public hiking the Lost Coast Trail needs to be informed that fishing in streams intersecting the trail is prohibited. In addition, they need to be more informed about the adverse effects of removing LWD from riparian areas and utilize reasonably sized pieces of wood for campfires. This public outreach can be effectively done by increasing signage and enforcement along the trail.

Minimize or Exclude Livestock Grazing in Riparian Areas

Minimizing the impacts from grazing and timber harvest should be a priority in reducing sedimentation and in improving riparian vegetation. Fencing riparian corridors and supplying adequate stock watering facilities away from creeks will prevent trampling and grazing in these areas.

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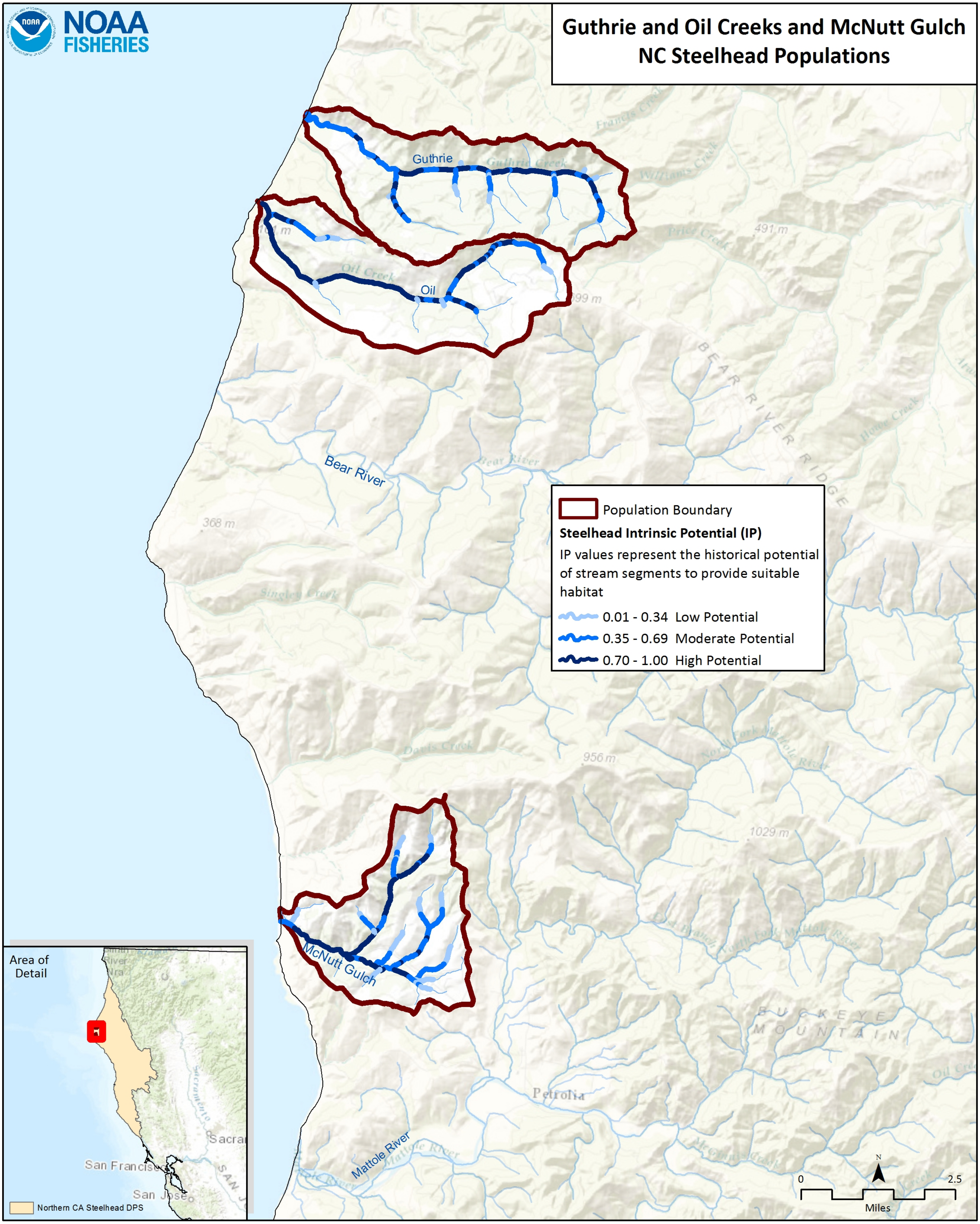
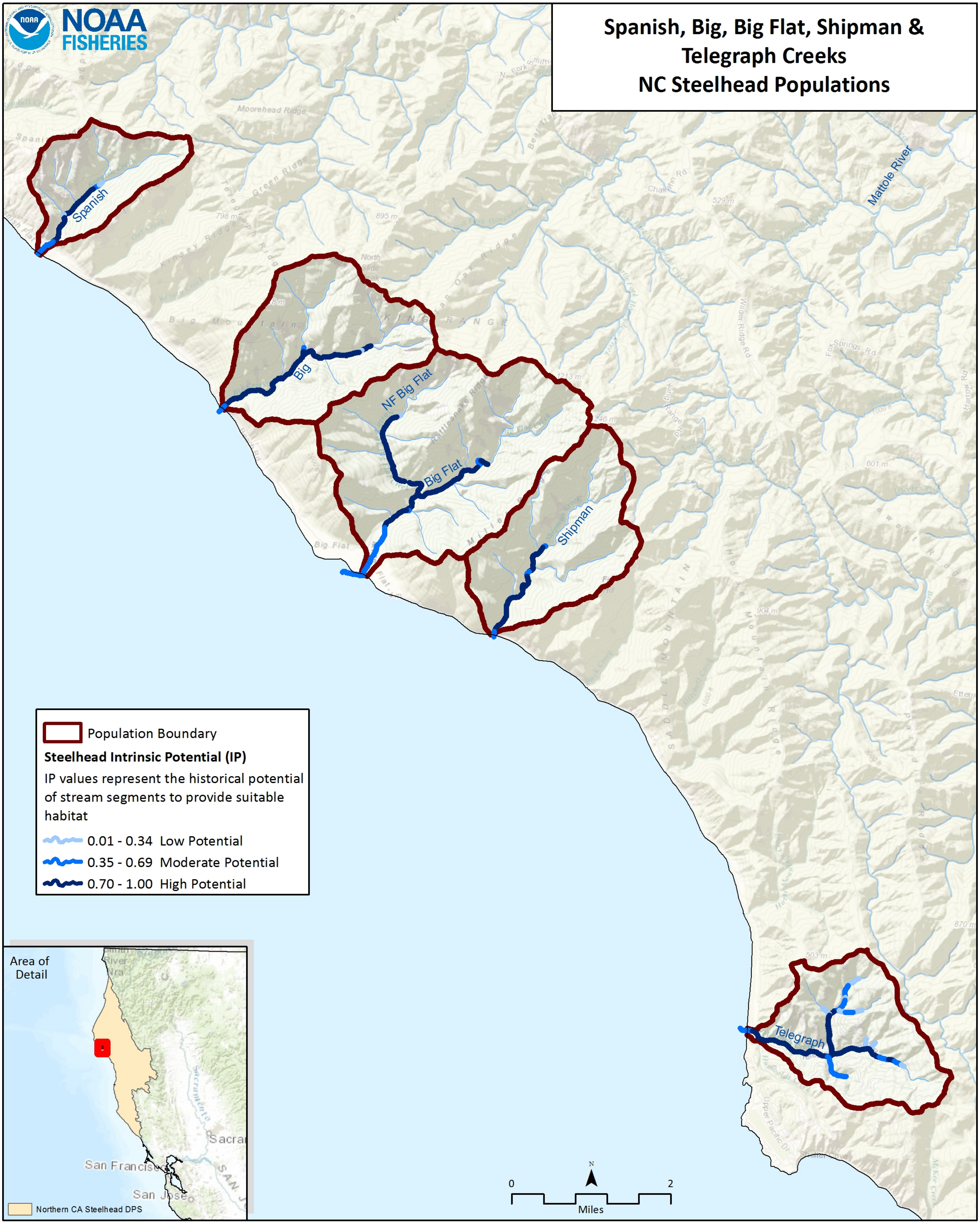
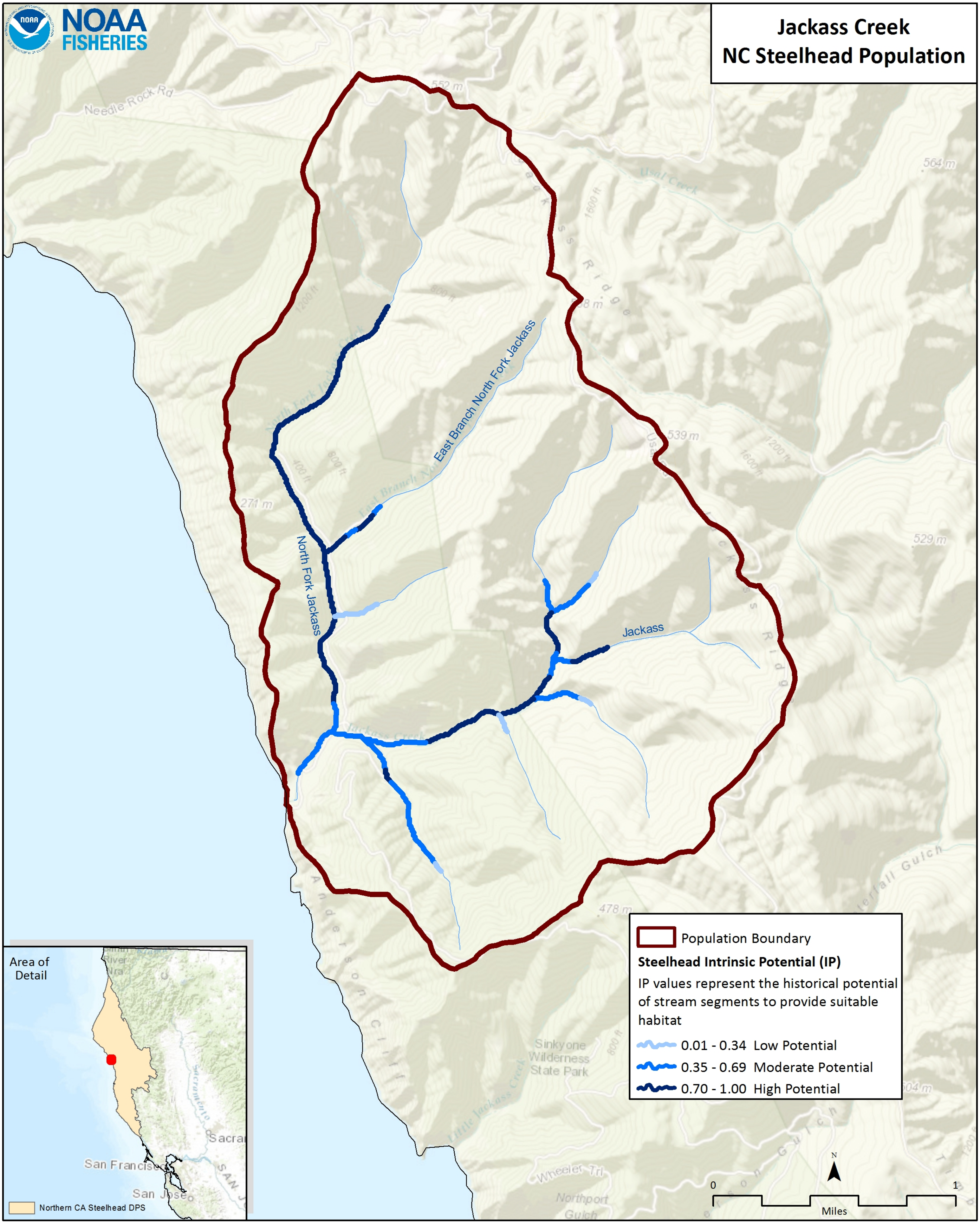


NOAA FISHERIES
Guthrie and Oil Creeks and McNutt Gulch
NC Steelhead Populations
Guthrie
Guthrie Creek
Francis Creek
Williams Creek
Oil Creek
Oil
Price Creek
491 m
399 m
BEAR RIVER RIDGE
Bear River
368 m
Singley Creek
Davis Creek
956 m
1029 m
McNutt Gulch
BUCKEYE MOUNTAIN
Petrolia
Mattole River
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
2.5
Miles
N
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS


Spanish, Big, Big Flat, Shipman & Telegraph Creeks
NC Steelhead Populations
NOAA FISHERIES
Spanish
Big
NF Big Flat
Big Flat
Shipman
Telegraph
Mattole River
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
0
2
Miles



NOAA FISHERIES
Jackass Creek
NC Steelhead Population
Needle Rock Rd
552 m
Usal Creek
564 m
East Branch North Fork Jackass
North Fork Jackass
Jackass
Jackass Creek
539 m
529 m
271 m
478 m
Anderson Cliff
Sinkyone Wilderness State Park
Little Jackass Creek
Wheeler Trl
Northport Gulch
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
0
1
Miles
N

NC Steelhead DPS: Northern Coastal Diversity Stratum (Guthrie/Oil/Jackass/McNutt/Spanish/Big/Big Flat/Shipman/Telegraph)						
Habitat & Population Condition Scores By Life Stage: VG = Very Good G = Good F = Fair P = Poor		Steelhead Life History Stages				
		Adults	Eggs	Summer-Rearing Juveniles	Winter-Rearing Juveniles	Smolts
Stresses: Key Attribute: Indicators	Riparian Vegetation: Composition, Cover & Tree Diameter			G	G	G
	Estuary: Quality & Extent	G		G	G	G
	Velocity Refuge: Floodplain Connectivity	G			G	G
	Hydrology: Redd Scour		G			
	Hydrology: Baseflow & Passage Flows	G	G	F		G
	Passage/Migration: Mouth or Confluence & Physical Barriers	F		F	VG	VG
	Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios	G		G	G	
	Habitat Complexity: Large Wood & Shelter	P		P	P	F
	Sediment: Gravel Quality & Distribution of Spawning Gravels	G	F	F	G	
	Viability: Density, Abundance & Spatial Structure	F		G		F
	Water Quality: Temperature			VG		VG
	Water Quality: Turbidity & Toxicity	VG		VG	G	G

NC Steelhead DPS: Northern Coastal Diversity Stratum (Guthrie/Oil/Jackass/McNutt/Spanish/Big/Big Flat/Shipman/Telegraph)

Threat Scores
L: Low
M: Medium
H: High

Threats - Sources of Stress	Stresses: Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Agriculture	L	L	L	L		L	L	L	L		L	L
Channel Modification	L	L	L	L	L	L	L	L	L		L	L
Disease, Predation, and Competition	L	L	L			L	L	L		L	L	L
Fire, Fuel Management, and Fire Suppression	L	L	L	L		L	L	L	L		L	L
Livestock Farming and Ranching	L	L	L	L		L	L	L	L		L	L
Logging and Wood Harvesting	M	L	L	L		L	L	H	L		L	L
Mining	L	L	L	L		L	L	L	L		L	L
Recreational Areas and Activities	L	L	L	L		L	L	H	L		L	L
Residential and Commercial Development	L	L	L	L		L	L	M	L		L	L
Roads and Railroads	L	L	L	L		L	L	M	M		L	L
Severe Weather Patterns	L	L	L	L	L	L	L	L	L		L	L
Water Diversions and Impoundments	L	L	L	L	H	H	L	L	L	L	L	L
Fishing and Collecting										M		
Hatcheries and Aquaculture										L	L	L

Guthrie Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GutC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
GutC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Existing areas with floodplains or off channel habitats should be protected from future urban development to the maximum extent possible.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-2.1.1.5	Action Step	Floodplain Connectivity	Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-2.1.1.6	Action Step	Floodplain Connectivity	Support landowners in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).	2	10	CalFire, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-2.1.1.7	Action Step	Floodplain Connectivity	Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.	2	5	CalFire, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic diversity)				
GutC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Encourage retention of large woody material in streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	25	CalFire, California Coastal Conservancy, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools.				
GutC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-6.1.3	Recovery Action	Habitat Complexity	Increase large wood frequency				
GutC-NCSW-6.1.3.1	Action Step	Habitat Complexity	Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB	
GutC-NCSW-6.1.3.2	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
GutC-NCSW-6.1.3.3	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	10	CalFire, CDFW, County, NCRWQB	
GutC-NCSW-6.1.3.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	10	CalFire, CDFW, Farm Bureau, Land Trusts, NCRWQB, NMFS	
GutC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter				
GutC-NCSW-6.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter of 80 (See NMFS/CDFW criteria).	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NRCS, Trout Unlimited	
GutC-NCSW-6.1.4.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NRCS, Trout Unlimited	

Guthrie Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GutC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
GutC-NCSW-7.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	2	10	CalFire	
GutC-NCSW-7.1.1.2	Action Step	Riparian	Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.	2	10	CalFire	
GutC-NCSW-7.1.2	Recovery Action	Riparian	Improve riparian condition				
GutC-NCSW-7.1.2.1	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	3	10	Land Trusts, The Nature Conservancy	
GutC-NCSW-7.1.2.2	Action Step	Riparian	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.	3	10	CalFire, CDFW, County	
GutC-NCSW-7.1.2.3	Action Step	Riparian	Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects.	2	10	Farm Bureau, NCRWQB, NRCS	
GutC-NCSW-7.1.2.4	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NCRWQB, NRCS	
GutC-NCSW-7.1.2.5	Action Step	Riparian	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	2	10	Farm Bureau, NCRWQB, NRCS	
GutC-NCSW-7.1.3	Recovery Action	Riparian	Improve tree diameter				
GutC-NCSW-7.1.3.1	Action Step	Riparian	Modify harvest rotation to increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	10	CalFire, CDFW	
GutC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-8.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment				
GutC-NCSW-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	3	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB, NRCS	
GutC-NCSW-8.1.1.2	Action Step	Sediment	Address sources from slides and gullies that deliver sediment and runoff to stream channels.	3	10	CalFire, NCRWQB, NRCS	
GutC-NCSW-8.1.1.3	Action Step	Sediment	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey	
GutC-NCSW-8.1.2	Recovery Action	Sediment	Improve gravel quantity and distribution for macro-invertebrate production (food)				
GutC-NCSW-8.1.2.1	Action Step	Sediment	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NRCS	
GutC-NCSW-8.1.2.2	Action Step	Sediment	Increase the percentage of gravel quality embeddedness to values of 1s and 2s (See NMFS Conservation Action Planning Attribute Table Report) in all current and potential juvenile salmonid summer and seasonal (fall/winter/spring) rearing areas.	2	5	CalFire, CDFW, NCRWQB, NRCS, Trout Unlimited	
GutC-NCSW-8.1.2.3	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program	
GutC-NCSW-8.1.2.4	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	3	5	CalFire, CDFW, Trout Unlimited	
GutC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
GutC-NCSW-11.1.1.1	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	3	10	CDFW, NMFS	
GutC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW, NMFS	
GutC-NCSW-11.1.1.3	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, NMFS	

Guthrie Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GutC-NCSW-11.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**				
GutC-NCSW-11.2.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
GutC-NCSW-11.2.1.1	Action Step	Viability	Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods (e.g. salmon analogs).	3	5	CDFW, NMFS	
GutC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
GutC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	20	CDFW, Farm Bureau, NRCS	
GutC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
GutC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	5	CDFW, Farm Bureau, NRCS	
GutC-NCSW-18.1.2.2	Action Step	Livestock	Exclusion fencing and off-stream water development should be explored and implemented within the watershed to address livestock damage in riparian areas.	2	5	CDFW, Farm Bureau, NCRWQB, NRCS	
GutC-NCSW-18.1.2.3	Action Step	Livestock	Implement water quality standards as outlined in the University of California guidelines for water quality protection (Ristow 2006).	2	10	Farm Bureau, NCRWQB, NRCS	
GutC-NCSW-18.1.2.4	Action Step	Livestock	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS	
GutC-NCSW-18.1.2.5	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	5	CDFW, Farm Bureau, Trout Unlimited	
GutC-NCSW-18.1.2.6	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB	
GutC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
GutC-NCSW-19.1.1.1	Action Step	Logging	Encourage CalFire and CDFW to increase harvest rotation time to conserve and manage forestlands for older forest stages.	3	10	CalFire, CDFW, NMFS	
GutC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	2	10	CDFW	
GutC-NCSW-19.1.1.3	Action Step	Logging	Encourage CalFire to reduce the amount and rate of even aged management through the timber harvest permitting process.	3	10	CalFire	
GutC-NCSW-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands or identified TPZ areas to rural residential or other land uses (e.g., vineyards).	3	10	CalFire	
GutC-NCSW-19.1.1.5	Action Step	Logging	Avoid or minimize new road construction in riparian zones (< 100 feet).	2	10	CalFire, Humboldt County	
GutC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
GutC-NCSW-19.1.2.1	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
GutC-NCSW-19.1.2.2	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	10	CalFire	
GutC-NCSW-19.1.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse as a result.	2	10	CalFire, California Geological Survey	
GutC-NCSW-19.1.2.4	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	10	CalFire	

Guthrie Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GutC-NCSW-19.1.2.5	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	10	CalFire, CDFW, Trout Unlimited	
GutC-NCSW-19.1.2.6	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	10	CalFire, CDFW, NMFS	
GutC-NCSW-19.1.2.7	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	2	10	CalFire, CDFW	
GutC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
GutC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	5	Five Counties Salmonid Conservation Program	
GutC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Avoid or minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	10	CalFire, Humboldt County	
GutC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	10	County, Farm Bureau, Five Counties Salmonid Conservation Program	
GutC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
GutC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.	2	10	CalFire, Counties, Farm Bureau, Five Counties Salmonid Conservation Program	
GutC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	10	CalFire, County, Farm Bureau, Five Counties Salmonid Conservation Program	
GutC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
GutC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	2	10	CalFire	
GutC-NCSW-23.1.1.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
GutC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	CalFire, Counties, Five Counties Salmonid Conservation Program	
GutC-NCSW-23.1.1.11	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	Five Counties Salmonid Conservation Program	
GutC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GutC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to watershed hydrology				
GutC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Encourage CDFW and the SWRCB to regulate diversion facilities to allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.	2	10	CDFW, State Water Resources Control Board	
GutC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	10	State Water Resources Control Board	
GutC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	DWR, NMFS, SWRCB	

Guthrie Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GutC-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	3	5	State Water Resources Control Board	

Oil Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OiC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
OiC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-2.1.2	Recovery Action	Floodplain Connectivity	Improve floodplain connectivity with the main channel				
OiC-NCSW-2.1.2.1	Action Step	Floodplain Connectivity	Existing areas with floodplains or off channel habitats should be protected from future urban development to the maximum extent possible.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-2.1.2.2	Action Step	Floodplain Connectivity	Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-2.1.2.3	Action Step	Floodplain Connectivity	Support landowners in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).	2	20	CalFire, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-2.1.2.4	Action Step	Floodplain Connectivity	Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.	2	5	CalFire, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic diversity)				
OiC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Encourage retention of large woody material in streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	25	CalFire, California Coastal Conservancy, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools				
OiC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-6.1.3	Recovery Action	Habitat Complexity	Increase large wood frequency				
OiC-NCSW-6.1.3.1	Action Step	Habitat Complexity	Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB	
OiC-NCSW-6.1.3.2	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
OiC-NCSW-6.1.3.3	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	10	CalFire, CDFW, County, NCRWQB	
OiC-NCSW-6.1.3.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	10	CalFire, CDFW, Farm Bureau, Land Trusts, NCRWQB, NMFS	
OiC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter				
OiC-NCSW-6.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter of 80 (See NMFS/CDFW criteria).	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NRCS, Trout Unlimited	

Oil Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OiC-NCSW-6.1.4.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NRCS, Trout Unlimited	
OiC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
OiC-NCSW-7.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	2	10	CalFire	
OiC-NCSW-7.1.1.2	Action Step	Riparian	Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.	2	10	CalFire	
OiC-NCSW-7.1.2	Recovery Action	Riparian	Improve riparian condition				
OiC-NCSW-7.1.2.1	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	3	20	Land Trusts, The Nature Conservancy	
OiC-NCSW-7.1.2.2	Action Step	Riparian	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.	3	30	CalFire, CDFW, County	
OiC-NCSW-7.1.2.3	Action Step	Riparian	Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects.	2	30	Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-7.1.2.4	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-7.1.2.5	Action Step	Riparian	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-7.1.2.6	Action Step	Riparian	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	2	50	Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-7.1.3	Recovery Action	Riparian	Improve tree diameter				
OiC-NCSW-7.1.3.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	10	CalFire, CDFW	
OiC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
OiC-NCSW-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	3	5	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB, NRCS	
OiC-NCSW-8.1.1.2	Action Step	Sediment	Address sources from slides and gullies that deliver sediment and runoff to stream channels.	3	10	CalFire, NCRWQB, NRCS	
OiC-NCSW-8.1.1.3	Action Step	Sediment	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey	
OiC-NCSW-8.1.1.4	Action Step	Sediment	Address high and medium priority sediment delivery sites	2	10	CalFire, Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-8.1.2	Recovery Action	Sediment	Improve gravel quantity and distribution for macro-invertebrate productivity (food)				
OiC-NCSW-8.1.2.1	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program	
OiC-NCSW-8.1.2.2	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	3	5	CalFire, CDFW, Trout Unlimited	
OiC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
OiC-NCSW-11.1.1.1	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW, Trout Unlimited	
OiC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, Trout Unlimited	
OiC-NCSW-11.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**				

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OiC-NCSW-11.2.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
OiC-NCSW-11.2.1.1	Action Step	Viability	Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods (e.g. salmon analogs).	3	5	CDFW, NMFS	
OiC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
OiC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	10	CDFW, Farm Bureau, NRCS	
OiC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
OiC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	5	CDFW, Farm Bureau, NRCS	
OiC-NCSW-18.1.2.2	Action Step	Livestock	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NRCS	
OiC-NCSW-18.1.2.3	Action Step	Livestock	Implement water quality standards as outlined in the University of California guidelines for water quality protection (Ristow 2006).	2	10	Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-18.1.2.4	Action Step	Livestock	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS	
OiC-NCSW-18.1.2.5	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	5	CDFW, Farm Bureau, Trout Unlimited	
OiC-NCSW-18.1.2.6	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB	
OiC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
OiC-NCSW-19.1.1.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	100	CalFire, CDFW, NCRWQB, NMFS	
OiC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.		20	CDFW	
OiC-NCSW-19.1.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	3	100	CalFire	
OiC-NCSW-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands or identified TPZ areas to rural residential or other land uses (e.g., vineyards).	3	25	CalFire	
OiC-NCSW-19.1.1.5	Action Step	Logging	Work with Calfire and CDFW through the timber harvest permitting process to avoid or minimize new road construction in riparian zones (< 100 feet).	2	10	CalFire, CDFW	
OiC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
OiC-NCSW-19.1.2.1	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
OiC-NCSW-19.1.2.2	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	50	CalFire	
OiC-NCSW-19.1.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse as a result.	2	50	CalFire, California Geological Survey	
OiC-NCSW-19.1.2.4	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	20	CalFire	
OiC-NCSW-19.1.2.5	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	10	CalFire, CDFW, Trout Unlimited	

Oil Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OiC-NCSW-19.1.2.6	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	20	CalFire, CDFW	
OiC-NCSW-19.1.2.7	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	2	10	CalFire, CDFW	
OiC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OiC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
OiC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	5	Five Counties Salmonid Conservation Program	
OiC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Work with Calfire and CDFW through the timber harvest permitting process to avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CDFW, NMFS	
OiC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	10	County, Farm Bureau, Five Counties Salmonid Conservation Program	
OiC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
OiC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.	2	10	CalFire, Counties, Farm Bureau, Five Counties Salmonid Conservation Program	
OiC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	10	CalFire, County, Farm Bureau, Five Counties Salmonid Conservation Program	
OiC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
OiC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	2	10	CalFire	
OiC-NCSW-23.1.1.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
OiC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	CalFire, Counties, Five Counties Salmonid Conservation Program	
OiC-NCSW-23.1.1.11	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	Five Counties Salmonid Conservation Program	
OiC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
OiC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
OiC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with CDFW and the SWRCB to allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.	2	10	CDFW, State Water Resources Control Board	
OiC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	10	State Water Resources Control Board	
OiC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Work with CDFW and the SWRCB to ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	CDFW, SWRCB, NMFS	
OiC-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	3	5	State Water Resources Control Board	

McNutt Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
McNC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
McNC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Work with recovery partners to protect existing areas with floodplains or off channel habitats from future urban development to the maximum extent possible.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-2.1.1.5	Action Step	Floodplain Connectivity	Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-2.1.1.6	Action Step	Floodplain Connectivity	Support landowners in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).	2	20	CalFire, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-2.1.1.7	Action Step	Floodplain Connectivity	Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.	2	5	CalFire, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic diversity)				
McNC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Encourage retention of large woody material in streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	25	CalFire, California Coastal Conservancy, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools				
McNC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-6.1.3	Recovery Action	Habitat Complexity	Increase large wood frequency				
McNC-NCSW-6.1.3.1	Action Step	Habitat Complexity	Work with recovery partners through the timber harvest permitting process to conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	2	10	CalFire, CDFW	
McNC-NCSW-6.1.3.2	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
McNC-NCSW-6.1.3.3	Action Step	Habitat Complexity	Work with recovery partners to increase harvest rotations to allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	10	CalFire, CDFW, County, NCRWQB	
McNC-NCSW-6.1.3.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	10	CalFire, CDFW, Farm Bureau, Land Trusts, NCRWQB, NMFS	
McNC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter				
McNC-NCSW-6.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter of 80 (See NMFS/CDFW criteria).	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NRCS, Trout Unlimited	

McNutt Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
McNC-NCSW-6.1.4.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NRCS, Trout Unlimited	
McNC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
McNC-NCSW-7.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	2	5	CalFire	
McNC-NCSW-7.1.1.2	Action Step	Riparian	Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.	2	10	CalFire	
McNC-NCSW-7.1.2	Recovery Action	Riparian	Improve riparian condition				
McNC-NCSW-7.1.2.1	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	3	20	Land Trusts, The Nature Conservancy	
McNC-NCSW-7.1.2.2	Action Step	Riparian	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.	3	30	CalFire, CDFW, County	
McNC-NCSW-7.1.2.3	Action Step	Riparian	Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects.	2	30	Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-7.1.2.4	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-7.1.2.5	Action Step	Riparian	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-7.1.2.6	Action Step	Riparian	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	2	50	Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-7.1.3	Recovery Action	Riparian	Improve tree diameter				
McNC-NCSW-7.1.3.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	10	CalFire, CDFW	
McNC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
McNC-NCSW-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	3	5	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB, NRCS	
McNC-NCSW-8.1.1.2	Action Step	Sediment	Address sources from slides and gullies that deliver sediment and runoff to stream channels.	3	10	CalFire, NCRWQB, NRCS	
McNC-NCSW-8.1.1.3	Action Step	Sediment	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey	
McNC-NCSW-8.1.1.4	Action Step	Sediment	Address high and medium priority sediment delivery sites	2	10	CalFire, Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-8.1.2	Recovery Action	Sediment	Improve gravel quantity and distribution for macro-invertebrate productivity (food)				
McNC-NCSW-8.1.2.1	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program	
McNC-NCSW-8.1.2.2	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	3	5	CalFire, CDFW, Trout Unlimited	
McNC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
McNC-NCSW-11.1.1.1	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW, NMFS	
McNC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, NMFS	
McNC-NCSW-11.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**				

McNutt Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
McNC-NCSW-11.2.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
McNC-NCSW-11.2.1.1	Action Step	Viability	Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods (e.g. salmon analogs).	3	5	CDFW, NMFS	
McNC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
McNC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	10	CDFW, Farm Bureau, NRCS	
McNC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
McNC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	5	CDFW, Farm Bureau, NRCS	
McNC-NCSW-18.1.2.2	Action Step	Livestock	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NRCS	
McNC-NCSW-18.1.2.3	Action Step	Livestock	Implement water quality standards as outlined in the University of California guidelines for water quality protection (Ristow 2006).	2	10	Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-18.1.2.4	Action Step	Livestock	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS	
McNC-NCSW-18.1.2.5	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	5	CDFW, Farm Bureau, Trout Unlimited	
McNC-NCSW-18.1.2.6	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB	
McNC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
McNC-NCSW-19.1.1.1	Action Step	Logging	Work with recovery partners to increase harvest rotation to conserve and manage forestlands for older forest stages.	3	100	CalFire, CDFW, NCRWQB, NMFS	
McNC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	3	20	CDFW	
McNC-NCSW-19.1.1.3	Action Step	Logging	Work with CalFire to increase harvest rotation to reduce the amount and rate of even aged management.	3	100	CalFire	
McNC-NCSW-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands or identified TPZ areas to rural residential or other land uses (e.g., vineyards).	3	25	CalFire	
McNC-NCSW-19.1.1.5	Action Step	Logging	Work with CalFire through the timber harvest permitting process to avoid or minimize new road construction in riparian zones (< 100 feet).	2	10	CalFire	
McNC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
McNC-NCSW-19.1.2.1	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
McNC-NCSW-19.1.2.2	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	50	CalFire	
McNC-NCSW-19.1.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse as a result.	2	50	CalFire, California Geological Survey	
McNC-NCSW-19.1.2.4	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	20	CalFire	
McNC-NCSW-19.1.2.5	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	10	CalFire, CDFW, Trout Unlimited	

McNutt Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
McNC-NCSW-19.1.2.6	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	20	CalFire, CDFW, NMFS	
McNC-NCSW-19.1.2.7	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	2	10	CalFire, CDFW	
McNC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
McNC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	5	Five Counties Salmonid Conservation Program	
McNC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Work with CalFire through the timber harvest permitting process to avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire	
McNC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	10	County, Farm Bureau, Five Counties Salmonid Conservation Program	
McNC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
McNC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.	2	10	CalFire, Counties, Farm Bureau, Five Counties Salmonid Conservation Program	
McNC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	10	CalFire, County, Farm Bureau, Five Counties Salmonid Conservation Program	
McNC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
McNC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	2	10	CalFire	
McNC-NCSW-23.1.1.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
McNC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	CalFire, Counties, Five Counties Salmonid Conservation Program	
McNC-NCSW-23.1.1.11	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	Five Counties Salmonid Conservation Program	
McNC-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
McNC-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
McNC-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Work with CDFW and the SWRCB to ensure diversion facilities allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.	2	10	CDFW, State Water Resources Control Board	
McNC-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	10	State Water Resources Control Board	
McNC-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Work with the SWRCB to ensure that current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	NMFS, SWRCB	
McNC-NCSW-25.1.1.4	Action Step	Water Diversion /Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	3	5	State Water Resources Control Board	

Spanish Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SpanC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SpanC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
SpanC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop and implement a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	BLM	
SpanC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
SpanC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
SpanC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	10	BLM, CDFW, CDFW Law Enforcement	
SpanC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult and juvenile steel head by increasing law enforcement.	3	20	BLM, CDFW, CDFW Law Enforcement	
SpanC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SpanC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
SpanC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
SpanC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
SpanC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
SpanC-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SpanC-NCSW-21.1.1	Recovery Action	Recreation	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
SpanC-NCSW-21.1.1.1	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about steelhead and how to minimize impacts.	2	10	BLM	
SpanC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SpanC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
SpanC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	5	BLM	
SpanC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	3	10	BLM	
SpanC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	3	10	BLM	
SpanC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	3	10	BLM	
SpanC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.	3	10	BLM	
SpanC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	3	10	BLM	

Spanish Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SpanC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	10	BLM	
SpanC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	BLM	
SpanC-NCSW-23.1.1.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	3	10	BLM	
SpanC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	BLM	
SpanC-NCSW-23.1.1.11	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	BLM	
SpanC-NCSW-23.1.1.12	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	10	BLM	
SpanC-NCSW-23.1.1.13	Action Step	Roads/Railroads	Encourage, when necessary and appropriate, restricted access to unpaved roads in winter to reduce road degradation and sediment release. Where restricted access is not feasible, encourage measures such as rocking to prevent sediment from reaching streams with salmonids (CDFG 2004).	3	10	BLM	

Big Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
BigC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop and implement a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	5	BLM	
BigC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement Large Wood Recruitment plan to address areas with low complexity.	2	5	BLM	
BigC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
BigC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
BigC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	10	BLM, CDFW, CDFW Law Enforcement	
BigC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult and juvenile steel head by increasing law enforcement.	3	10	BLM, CDFW, CDFW Law Enforcement	
BigC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BigC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
BigC-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigC-NCSW-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
BigC-NCSW-21.1.1.1	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about steelhead and how to minimize impacts.	2	5	BLM	

Big Flat Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigFC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigFC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
BigFC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	5	BLM	
BigFC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement Large Wood Recruitment plan to address areas with low complexity.	2	5	BLM	
BigFC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
BigFC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
BigFC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	50	BLM, CDFW, CDFW Law Enforcement	
BigFC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult and juvenile steel head by increasing law enforcement.	3	25	BLM, CDFW, CDFW Law Enforcement	
BigFC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigFC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BigFC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
BigFC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
BigFC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
BigFC-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigFC-NCSW-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
BigFC-NCSW-21.1.1.1	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about steelhead and how to minimize impacts.	2	10	BLM	

Shipman Creek (Northern Coastal) Threats and Associated Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ShipC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ShipC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
ShipC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop and implement a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	BLM	
ShipC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
ShipC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
ShipC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	10	BLM, CDFW, CDFW Law Enforcement	
ShipC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult and juvenile steel head by increasing law enforcement.	3	10	BLM, CDFW, CDFW Law Enforcement	
ShipC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ShipC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
ShipC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
ShipC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
ShipC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	10	BLM	
ShipC-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ShipC-NCSW-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
ShipC-NCSW-21.1.1.1	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about steelhead and how to minimize impacts.	2	10	BLM	

Telegraph Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TGC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TGC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
TGC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	10	Community of Shelter Cove	
TGC-NCSW-3.1.1.2	Action Step	Hydrology	Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers. Work with the community of Shelter Cove and private landowners in the upper watershed to reduce diversion during the low flow summer period.	2	10	Community of Shelter Cove	
TGC-NCSW-3.1.1.3	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	State Water Resources Control Board	
TGC-NCSW-3.1.1.4	Action Step	Hydrology	Promote off-channel storage and conservation measures to reduce impacts of summer and early fall water diversions (e.g. storage tanks for rural residential users).	2	10	Community of Shelter Cove, State Water Resources Control Board	
TGC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TGC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
TGC-NCSW-5.1.1.1	Action Step	Passage	Remove or modify Telegraph Creek Dam to facilitate passage of all life stages of steelhead.	3	5	CDFW, Community of Shelter Cove	
TGC-NCSW-5.1.1.2	Action Step	Passage	If Telegraph creek Dam is modified to facilitate passage of all steelhead life stages, conduct post project monitoring to ensure steelhead successfully pass.	3	10	Community of Shelter Cove	
TGC-NCSW-5.1.1.3	Action Step	Passage	Remove triple culvert road crossing upstream of the Telegraph Creek dam.	3	5	Community of Shelter Cove, County, Five Counties Salmonid Conservation Program	
TGC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TGC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic ratio)				
TGC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	3	2	CDFW	
TGC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Encourage retention of large woody material in streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	10	Community of Shelter Cove	
TGC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools.				
TGC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	3	10	CDFW, Community of Shelter Cove, NMFS	
TGC-NCSW-6.1.3	Recovery Action	Habitat Complexity	Increase large wood frequency				
TGC-NCSW-6.1.3.1	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	5	CDFW, NOAA RC	
TGC-NCSW-6.1.3.2	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	10	Community of Shelter Cove	
TGC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Increase shelter				
TGC-NCSW-6.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter of 80 (See NMFS/CDFW criteria).	2	5	CDFW, Community of Shelter Cove	
TGC-NCSW-6.1.4.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CDFW, Community of Shelter Cove	
TGC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TGC-NCSW-8.1.1	Recovery Action	Sediment	Improve gravel quality and distribution for macro-invertebrate productivity (food)				

Telegraph Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TGC-NCSW-8.1.1.1	Action Step	Sediment	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	10	Community of Shelter Cove, Five Counties Salmonid Conservation Program	
TGC-NCSW-8.1.1.2	Action Step	Sediment	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	County, Five Counties Salmonid Conservation Program	
TGC-NCSW-8.1.1.3	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	3	10	County, Five Counties Salmonid Conservation Program	
TGC-NCSW-8.1.1.4	Action Step	Sediment	Address high and medium priority sediment delivery sites	3	10	Community of Shelter Cove, County, Five Counties Salmonid Conservation Program	
TGC-NCSW-8.1.2	Recovery Action	Sediment	Improve instream gravel quality				
TGC-NCSW-8.1.2.1	Action Step	Sediment	Establish and/or maintain continuous and properly functioning native riparian buffers.	2	10	Community of Shelter Cove	
TGC-NCSW-8.1.2.2	Action Step	Sediment	Increase the quantity and distribution of spawning gravels in 50% of streams within the watershed	2	5	Community of Shelter Cove, Five Counties Salmonid Conservation Program	
TGC-NCSW-8.1.2.3	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	5	CDFW, Community of Shelter Cove	
TGC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TGC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
TGC-NCSW-11.1.1.1	Action Step	Viability	Conduct an instream habitat assessment to develop restoration recommendations	3	10	CDFW	
TGC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW	
TGC-NCSW-11.1.1.3	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	5	CDFW	
TGC-NCSW-11.1.1.4	Action Step	Viability	Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.	3	5	CDFW	
TGC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TGC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TGC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB and Private Landowners to allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.	2	10	Community of Shelter Cove, State Water Resources Control Board	
TGC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	10	Community of Shelter Cove, State Water Resources Control Board	
TGC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	3	10	DWR, NMFS, SWRCB	
TGC-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	2	5	Community of Shelter Cove	

Jackass Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
JacAC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic diversity)				
JacAC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	5	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
JacAC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Encourage retention of large woody material in streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	10	CalFire, California Coastal Conservancy, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
JacAC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools				
JacAC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
JacAC-NCSW-6.1.3	Recovery Action	Habitat Complexity	Improve large wood frequency				
JacAC-NCSW-6.1.3.1	Action Step	Habitat Complexity	Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	2	50	CalFire, California Coastal Conservancy, CDFW, InterTribal Sinkyone Wilderness Council, NCRWQB	
JacAC-NCSW-6.1.3.2	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	5	CalFire, California Coastal Conservancy, CDFW, InterTribal Sinkyone Wilderness Council, NCRWQB, NMFS, NOAA RC, Trout Unlimited	
JacAC-NCSW-6.1.3.3	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	50	CalFire, CDFW, County, InterTribal Sinkyone Wilderness Council, NCRWQB	
JacAC-NCSW-6.1.3.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	30	CalFire, CDFW, Farm Bureau, Land Trusts, NCRWQB, NMFS	
JacAC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter				
JacAC-NCSW-6.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter of 80 (See NMFS/CDFW criteria).	2	5	CalFire, California Coastal Conservancy, CDFW, InterTribal Sinkyone Wilderness Council, NCRWQB, NMFS, NRCS, Trout Unlimited	
JacAC-NCSW-6.1.4.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CalFire, California Coastal Conservancy, CDFW, InterTribal Sinkyone Wilderness Council, NCRWQB, NMFS, NRCS, Trout Unlimited	
JacAC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover and species composition				
JacAC-NCSW-7.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	2	10	CalFire	
JacAC-NCSW-7.1.1.2	Action Step	Riparian	Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.	2	10	CalFire	
JacAC-NCSW-7.1.2	Recovery Action	Riparian	Improve riparian condition				
JacAC-NCSW-7.1.2.1	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	3	10	Land Trusts, The Nature Conservancy	
JacAC-NCSW-7.1.2.2	Action Step	Riparian	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.	3	10	CalFire, CDFW, County	

Jackass Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
JacAC-NCSW-7.1.2.3	Action Step	Riparian	Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects.	2	10	Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-7.1.2.4	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-7.1.2.5	Action Step	Riparian	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-7.1.2.6	Action Step	Riparian	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	2	10	Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-7.1.3	Recovery Action	Riparian	Improve tree diameter				
JacAC-NCSW-7.1.3.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	10	CalFire, CDFW	
JacAC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
JacAC-NCSW-11.1.1.1	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW, NMFS	
JacAC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, NMFS	
JacAC-NCSW-11.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**				
JacAC-NCSW-11.2.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
JacAC-NCSW-11.2.1.1	Action Step	Viability	Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods (e.g. salmon analogs).	3	10	CDFW, NMFS	
JacAC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
JacAC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
JacAC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	2	10	CDFW Law Enforcement, NMFS OLE, State Parks	
JacAC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead and coho salmon by increasing law enforcement.	2	10	CDFW Law Enforcement, NMFS OLE, State Parks	
JacAC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
JacAC-NCSW-18.1.1.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	5	CDFW, Farm Bureau, NRCS	
JacAC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
JacAC-NCSW-18.1.2.1	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	5	CDFW, Farm Bureau, NRCS	
JacAC-NCSW-18.1.2.2	Action Step	Livestock	Exclusion fencing and off-stream water development should be explored and implemented within the watershed to address livestock damage in riparian areas.	2	5	CDFW, Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-18.1.2.3	Action Step	Livestock	Implement water quality standards as outlined in the University of California guidelines for water quality protection (Ristow 2006).	2	20	Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-18.1.2.4	Action Step	Livestock	Locate water sources away from riparian areas.	2	10	Farm Bureau, NCRWQB, NRCS	
JacAC-NCSW-18.1.2.5	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	5	CDFW, Farm Bureau, Trout Unlimited	
JacAC-NCSW-18.1.2.6	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB	

Jackass Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
JacAC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
JacAC-NCSW-19.1.1.1	Action Step	Logging	Work with CalFire, and CDFW to implement longer harvest rotations through the harvest permitting process to conserve and manage forestlands for older forest stages.	3	50	CalFire, CDFW, NCRWQB, NMFS	
JacAC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	2	10	CDFW	
JacAC-NCSW-19.1.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	3	50	CalFire	
JacAC-NCSW-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands or identified TPZ areas to rural residential or other land uses (e.g., vineyards).	3	100	CalFire	
JacAC-NCSW-19.1.1.5	Action Step	Logging	Work with CalFire and Humboldt County to avoid or minimize permitting new road construction in riparian zones (< 100 feet).	2	10	CalFire, Humboldt County	
JacAC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
JacAC-NCSW-19.1.2.1	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	100	CalFire	
JacAC-NCSW-19.1.2.2	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	25	CalFire	
JacAC-NCSW-19.1.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse as a result.	2	10	CalFire, California Geological Survey	
JacAC-NCSW-19.1.2.4	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	10	CalFire	
JacAC-NCSW-19.1.2.5	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	10	CalFire, CDFW, Trout Unlimited	
JacAC-NCSW-19.1.2.6	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	10	CalFire, CDFW, NMFS	
JacAC-NCSW-19.1.2.7	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	2	10	CalFire, CDFW	
JacAC-NCSW-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
JacAC-NCSW-21.1.1.1	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about steelhead and how to minimize impacts.	2	5	InterTribal Sinkyone Wilderness Council, State Parks	
JacAC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
JacAC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	5	Five Counties Salmonid Conservation Program	
JacAC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Work with CalFire and the County to avoid or minimize permitting new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, Humboldt County	
JacAC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	10	County, Farm Bureau, Five Counties Salmonid Conservation Program	
JacAC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	

Jackass Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
JacAC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.	2	10	CalFire, Counties, Farm Bureau, Five Counties Salmonid Conservation Program	
JacAC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	10	CalFire, County, Farm Bureau, Five Counties Salmonid Conservation Program	
JacAC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	10	CalFire, Farm Bureau, Five Counties Salmonid Conservation Program, NCRWQB	
JacAC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	2	10	CalFire	
JacAC-NCSW-23.1.1.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	10	CalFire	
JacAC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	CalFire, Counties, Five Counties Salmonid Conservation Program	
JacAC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JacAC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to watershed hydrology				
JacAC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with CDFW and the SWRCB to ensure diversion facilities allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.	2	10	CDFW, State Water Resources Control Board	
JacAC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	10	State Water Resources Control Board	
JacAC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to ensure that current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	NMFS, SWRCB	
JacAC-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	3		State Water Resources Control Board	

NC Steelhead DPS Rapid Assessment Profile: Northern Coastal Diversity Stratum Populations (Lower Eel River Tributaries and Howe Creek)

Lower Eel River Tributaries

- Role within DPS: Dependent Population
- Spawner Abundance Target: 996-1,995 adults
- Current Intrinsic Potential: 166.4 IP-km

Howe Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 81-165 adults
- Current Intrinsic Potential: 13.9 IP-km

Abundance and Distribution

Populations in this stratum assessment include two dependent populations, Lower Eel River tributaries and Howe Creek. The Lower Eel River tributaries population is in a set of small tributaries to the lower mainstem Eel River, and the population is considered dependent by Spence *et al.* (2012). The Howe Creek population is another slightly larger dependent population in a tributary to the lower mainstem. No steelhead abundance data is available for streams in this stratum, but fish distribution information has been collected by CDFW and private timber companies since the 1950s.

Current steelhead presence across the stratum is reduced compared to the potential habitat estimated by Spence *et al.* (2012). Most of the larger tributaries that make up this stratum that have been surveyed in the last 10 years are occupied by steelhead. In the Salt River drainage, steelhead are present in Reas and Francis creeks but have not been found in Williams and Coffee creeks (CDFG 2010). Also, tributaries that flow through the city of Fortuna, such as Strongs and Rohner creeks are reported to have steelhead presence (CDFG 2010). The smaller tributaries north of Rohner Creek such as Palmer Creek, Finch, and other small unnamed tributaries are currently not occupied by steelhead (Becker and Reining 2009). Many of the remaining tributaries within the stratum from Howe Creek to Weber Creek have been found to have steelhead juveniles, although the surveys are generally from the late 1990s. Many of the small tributary drainages along the upstream portion of the stratum are not occupied by steelhead, with most blocked by railroad or highway crossings.

History of Land Use, Land Management and Current Resources

Prior to the first European settlers, the Wiyot people inhabited the Lower Eel River Basin. In the early 1850s the European settlers arrived to prospect for gold, and over time converted the delta area for dairies and agriculture. Historically, the Salt River Delta was densely vegetated and a large portion was comprised of tidal lands; now due to the construction of tidegates and levees the vast majority of this tidal area is in agricultural production (CDFG 2010). Tributary watersheds along the lower mainstem Eel River have had urban development and timber harvest as their main land uses in the last 150 years. The city of Fortuna was incorporated in 1906, and has grown to an area of about 5 square miles (Mintier and Associates 2006, as cited in CDFG 2010). Other small towns within the stratum include Ferndale, located near the estuary, and town of Rio Dell along the mainstem Eel River.

The Pacific Lumber Company began logging the lower Eel River area in the 1890s with horses, oxen, and steam donkeys. Following WWII, mechanized logging was conducted in many areas of the watershed. Due to the near-absence of regulations, many areas were harvested with poor logging practices including road construction on steep hillsides. In the harvested areas, the watershed was then susceptible to massive erosion as the result of record rainfall and floods in 1955 and 1964 (USEPA 2005). The erosion resulted in increased sediment being deposited in stream channels, filling in most deep pools (Lisle 1982). Stream reaches became wide and shallow, with reduced riparian vegetation for stabilization or shade.

In parts of the Lower Eel River basin grazing and residential development occurred over time that has further degraded stream reaches. Livestock has unrestricted access to many tributaries, resulting in degraded riparian areas and increased bank erosion (CDFG 2010).

Diversity Stratum Population and Habitat Conditions

Based on the best available stream survey information, floodplain connectivity rates Poor as a condition to the selected tributary streams in the Northern Coastal Stratum. This rating is due to the loss of wetlands, sloughs and salt marshes in the tributaries draining into the Eel River estuary. Many of the habitat conditions for tributaries along the lower Eel from Howe Creek upstream are rated as Fair. Conditions rated as Fair for these tributaries are associated with poor habitat conditions, and include reduced habitat complexity and pools, altered riparian composition, reduced LWD, increased turbidity, and impaired gravel quality. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on the conditions is abated. The following discussion focuses on those conditions that rate as Poor or Fair for the steelhead life history stages (see "Northern Coastal Stratum" Rapid Assessment). These were streamflows, passage and migration, pool frequency, LWD and shelter, gravel quality and quantity, abundance, and stream temperatures. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and functioning watershed processes.

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian conditions are rated as Fair for the target lifestages, and was found limiting in a few of the selected tributaries in this stratum. Most streams in this stratum were found to have canopies over 50 percent, but many did not meet the target value of 80 percent set forth by CDFG (2010). Much of riparian area associated with the estuary, or streams that drain to the estuary, have been cleared to create pasture land for dairy cattle. Restoration of salt tolerant species in salt marshes and sloughs is a key recovery action in these areas.

Estuary: Quality and Extent

Estuary conditions are discussed in the overall section for the Eel River watershed. In summary, much of these areas have been lost due to past land development for dairies, agriculture, and residential use. Tide gates, levees, and channelization have impacted flow, sediment transport, and water quality of tidal areas and streams draining into the Eel River estuary. Losses in estuarine and stream habitat in this area has reduced fish passage and rearing opportunity for salmonids emigrating from the entire Eel River watershed.

Velocity Refuge: Floodplain Connectivity

Velocity Refuge: Floodplain Connectivity is rated as Poor for the target lifestages. These effects are associated with losses in floodplain connection in the Salt River, its tributaries and other sloughs surrounding the Eel River estuary. Tidegates and levees in the Salt River basin impact fish passage, water quality, habitat quality, and sediment transport (CDFG 2010).

Hydrology: Baseflow and Passage Flows

Hydrology: Baseflow and Passage Flows are rated as Fair for the target lifestages and are found to be limiting in specific areas of this stratum. Hydrology throughout the Salt River basin has been modified by tidegates, levees, and stream channelizing for cattle and agricultural activities. Tributaries that pass through Fortuna such as Strongs and Rohner creeks likely experience some increases in peak flow due to urban development in this area. Minor increases in peak flow is also expected in the tributaries in the upper part this stratum such as Howe, Nanning and Dean creeks, *etc*. due to timber harvest in these watersheds from 1989– 2005.

Passage/Migration: Mouth or Confluence and Physical Barriers

Passage conditions in these selected tributaries are typically impacted by existing road crossings that could prevent or impede passage for adult fish during the winter or for juvenile fish during low flows. Passage for adult and juvenile fish is rated as Poor and limits steelhead distribution across this stratum. Tidegates and road crossings in the Salt River, and many road crossings in Fortuna on Rohner and the Strongs creeks drainages have six identified passage sites that are either partial or total barriers. Also, Highway 101 along the lower Eel River creates passage barriers for many small tributaries in the stratum.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Altered pool frequency for this stratum is rated as Fair for steelhead lifestages. Coastal Watershed Assessment and Planning analysis (CDFG 2010) reports that the majority of streams in the Lower Eel River basin are below target values (30-50% by length) for primary pools by length stream.

Habitat Complexity: Large Wood and Shelter

Habitat Complexity: Large Wood and Shelter is rated as Fair for steelhead across this stratum. Past timber harvesting along tributaries in the upstream portion of the stratum, agricultural activities in the estuarine area, and rural/urban development in the middle area of the stratum have all contributed to reducing large riparian trees that provide LWD and shelter to streams. Wood removal programs in the past removed and reduced the quantity and quality of large wood pieces available for fish in stream channels. Past timber harvesting removed riparian trees, which reduced the potential for future wood recruitment to streams. Large storm events have further reduced habitat complexity through sedimentation and a reduction in pool depths.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Past land use practices occurring on highly erodible Wildcat soils have contributed to increased sediment delivery to stream channels draining into the estuary. Also, tidegates and levees in the Salt River basin have affected sediment transport and caused aggradation in Salt River, and its tributaries of Reas and Coffee creeks thereby reducing historic habitat quality.

Viability: Density, Abundance and Spatial Structure

Steelhead distribution throughout the stratum is affected by poor passage conditions. Many tributaries such as Williams and Coffee in the Salt River drainage, tributaries to Strongs Creek and many small unnamed tributaries that drain directly to the lower Eel River do not have steelhead occupancy at this time. Based on steelhead distribution data provided by CDFG, we estimate that occupancy occurs in about 50 percent of the streams across this stratum that includes Howe Creek and tributaries to the lower Eel River.

Water Quality: Temperature

Water Quality: Temperature is rated as Fair for steelhead lifestages in this stratum. Most streams in this stratum are within a suitable range for salmonids (CDFG 2010). The Fortuna Creeks Project has conducted monitoring in the Fortuna area and found streams to have stressful stream temperatures for salmonids, with Rohner Creek the most unsuitable (CDFG 2010).

Water Quality: Turbidity or Toxicity

Turbidity and toxicity are rated as Fair for the target lifestages in this stratum. Water quality is impacted by cattle waste in the estuary, and many tributary streams where grazing occurs. Water treatment facilities in Ferndale, Fernbridge, Loleta, and Fortuna are frequently out of compliance for discharges to the Eel River.

Threats

The following discussion focuses on those threats that rate as a primary or secondary concern (see "Northern Coastal Stratum" Rapid Assessment Results). Recovery strategies will focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in "Northern Coastal Stratum" Rapid Assessment Results.

Agriculture

Most current agricultural activity provides feed for dairy and beef cattle. Livestock have unrestricted access in some streams of the Lower Eel Basin causing stream bank erosion and riparian vegetation damage (CDFG 2010). A few row crops are still planted, and pasture grasses are bailed for winter feed supplies for cattle (CDFG 2010). Agricultural practices typically include stream channelization, large woody debris removal, construction of revetments (bank armoring), and removal of natural riparian vegetation (Spence *et al*. 1996).

Channel Modification

The effects of past channel modification, including tide gates, levees, draining, and diking is expected to continue into the future. Tideland reclamation and the construction of dikes and levees for agricultural purposes have changed the natural function of the estuary considerably. Slough and creek channels that once meandered throughout the delta are now confined by levees, sufficiently slowing flow to a point that many have become filled with sediment (CDFG 2010). The extent of future channel modification is expected to be minimal as most tributaries draining into the estuary have undergone extensive disturbance. Further channel modification is not likely to occur due to the current environmental permits and oversight required to conduct these actions.

Livestock Farming and Ranching

Today much of the land that was cleared in the late 1800s is used to produce dairy and beef products. These activities are likely to be maintained over the next ten years with ongoing impacts of cattle on riparian areas and water quality. Water quality in the estuary and sloughs has been monitored in the recent past to determine dissolved oxygen levels, fecal coliform, hydrocarbons and priority metals. The Wiyot Tribe that conducted the sampling in 2004—2007 found dissolved oxygen levels just above 5.0 mg/liter, high coliform bacteria levels, and no hydrocarbons or priority metals (CDFG 2010).

Logging and Wood Harvesting

Timber harvest activities occur in the upstream tributaries of this stratum. Timber harvest in this area is managed under Habitat Conservation Plans (HCPs) by large industrial timber companies. Moderate effects are expected from ongoing and future timber harvesting due to improved practices under HCPs. One area of concern is the headwaters of Strongs and North Strongs creeks that are comprised of highly erodible soils and is susceptible to erosion from timber harvest activities.

Residential and Commercial Development

Rural residential development will likely become an increasing threat in the future. Fortuna, Ferndale, and Rio Dell all have issues with wastewater discharge that impacts water quality in the Eel River and its estuary.

Roads and Railroads

Many passage issues exist in this stratum with roads in the middle and upstream tributaries and tidegates in the estuary tributaries. Highway 101 is the primary road that causes passage barriers at many small tributaries that drain to the lower Eel River. Also, Highway 254, Shively Road, and roads in the Rio dell and Fortuna areas create passage problems for anadromous fish. The non-functioning Northwestern Pacific Railroad also impedes fish passage at a few stream crossings including Little Palmer Creek and Bridge Creek.

Limiting Conditions, Lifestages, and Habitats

Tributary habitat that drains the estuary portion of this stratum has gone through extensive land use development. These tributaries and sloughs have lost size and function due to the development of grazing, and agricultural land around the estuary. Tributaries in the middle and upper areas of the stratum have been impacted by urban development and timber harvesting activities since the disturbance regime set forth by European settlers.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating conditions and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in this Stratum are discussed below with more detailed and site-specific recovery actions provided in "Northern Coastal Stratum" Rapid Assessment.

Our approach to recover steelhead in this stratum is to work closely with landowners to improve the natural drainage, water quality and function of the Salt River and its tributaries, and sloughs located around the estuary. In the middle and upper portion of this stratum fish passage needs to be improved to provide habitat availability in tributary streams within this stratum. In forested areas of the upper basin, habitat suitability improvements need to continue through instream habitat programs.

Improve Passage

Improved passage for salmonids is needed in the Salt River basin. Tidegates need to be modified or removed to allow passage for all lifestages of steelhead. Road crossings also cause passage problems in tributaries of the Salt River, tributaries in the Fortuna area, and along Highway 101 and roads adjacent to the lower mainstem Eel River.

Improve Water Quality

Much of the lower Eel River around the estuary has been converted into dairy and grazing pastures. Riparian protection areas need to be established to protect the Salt River and various sloughs from the impacts of dairy and cattle grazing run-off. The five wastewater facilities that drain into the lower Eel River basin need to meet permit requirements that protect water quality standards.

Improve Floodplain Connectivity

Channel improvements and slough rehabilitation in the Salt River and sloughs around the estuary need to continue to improve function of tidal and salt marsh habitat. Conservation easements, land purchases, or tools such as safe harbor agreements should be sought with landowners in order to reclaim tributary areas that drain into or that are part of the historical estuary footprint.

Increase Instream Shelter Ratings and Pool Volume

Shelter ratings are unsuitable in all surveyed stream reaches of most tributaries in this stratum. Due largely to an absence of LWD, quality pool habitat is scarce and shelter components are comprised mainly of undercut banks and cobble substrate. Where applicable, restoration efforts should incorporate instream wood/boulder structures and/or large conifers (*i.e.*, fall trees into creek) within degraded reaches to improve shelter and overall habitat complexity.

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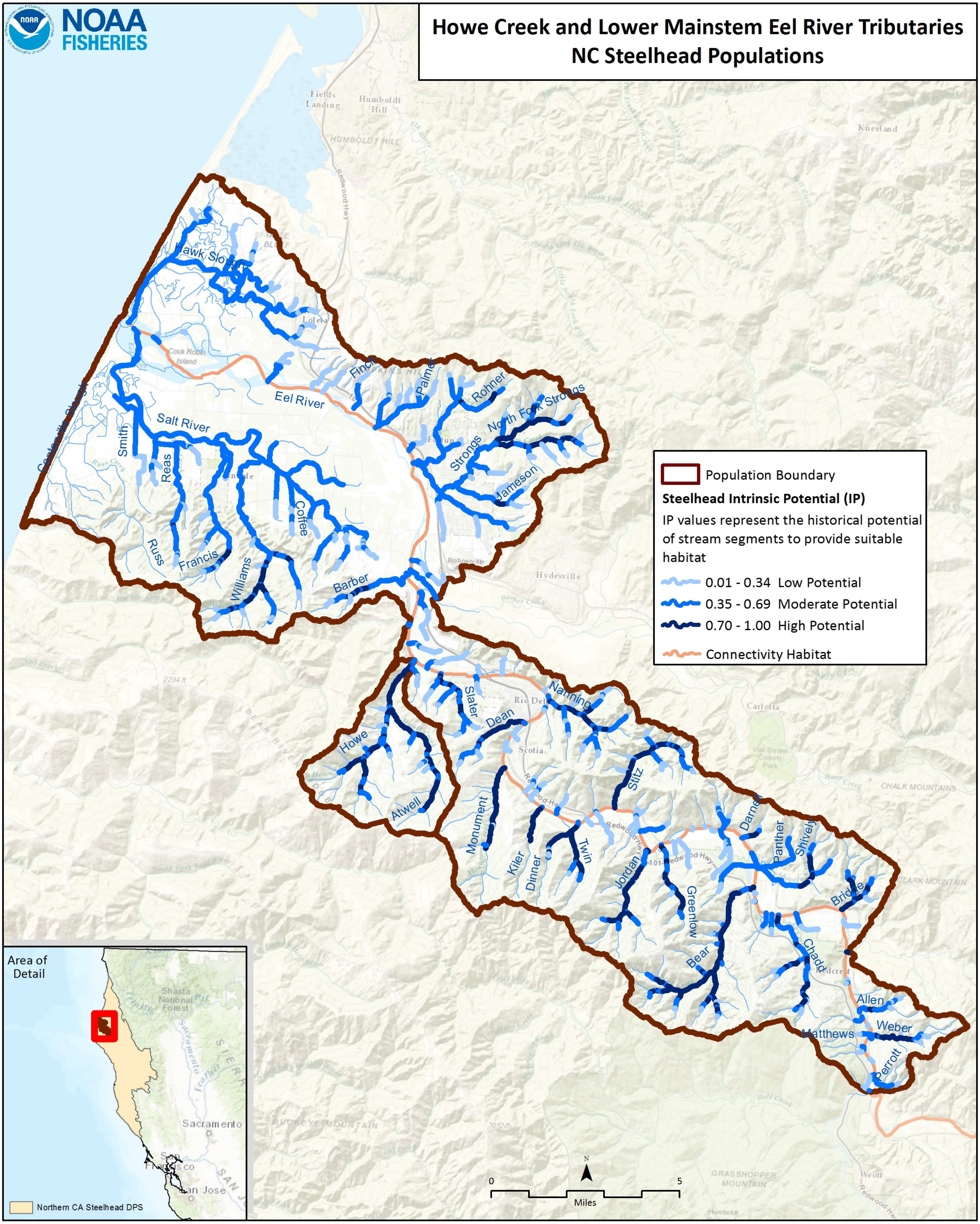
Howe Creek and Lower Mainstem Eel River Tributaries NC Steelhead Populations



NC Steelhead DPS: Northern Coastal Diversity Stratum (Lower Mainstem Eel Tributaries/Howe)						
Habitat & Population Condition Scores By Life Stage: VG = Very Good G = Good F = Fair P = Poor		**Steelhead Life History Stages**				
		Adults	**Eggs**	**Summer-Rearing Juveniles**	**Winter-Rearing Juveniles**	**Smolts**
Stresses: Key Attribute: Indicators	Riparian Vegetation: Composition, Cover & Tree Diameter			F	F	
	Estuary: Quality & Extent	P		P	P	P
	Velocity Refuge: Floodplain Connectivity	F			P	G
	Hydrology: Redd Scour		G			
	Hydrology: Baseflow & Passage Flows	G	G	F		G
	Passage/Migration: Mouth or Confluence & Physical Barriers	P		G	G	G
	Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios	G		F	F	
	Habitat Complexity: Large Wood & Shelter	G		F	F	F
	Sediment: Gravel Quality & Distribution of Spawning Gravels	F	F	F	F	
	Viability: Density, Abundance & Spatial Structure	G		F		F
	Water Quality: Temperature			F		G
	Water Quality: Turbidity & Toxicity	G		F	F	G

NC Steelhead DPS: Northern Coastal Diversity Stratum (Lower Mainstem Eel Tributaries/Howe)

Threat Scores
L: Low
M: Medium
H: High

Threats - Sources of Stress	Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Agriculture	M	H	H	L		H	L	L	L		M	M
Channel Modification	M	H	H	L	L	M	L	L	L		L	L
Disease, Predation, and Competition	L	L	L			L	L	L		L	L	L
Fire, Fuel Management, and Fire Suppression	L	M	M	L		L	L	L	L		L	L
Livestock Farming and Ranching	M	H	H	L		M	L	L	L		L	L
Logging and Wood Harvesting	M	M	M	L		M	L	M	M		M	M
Mining	L	M	M	L		M	L	L	L		L	L
Recreational Areas and Activities	L	L	L	L		M	L	L	L		L	L
Residential and Commercial Development	L	L	H	L		M	L	L	L		L	L
Roads and Railroads	L	L	L	L		H	L	L	M		L	M
Severe Weather Patterns	L	L	L	L	L	M	L	L	M		L	L
Water Diversions and Impoundments	L	H	L	L	L	L	L	L	L	L	L	L
Fishing and Collecting										L		
Hatcheries and Aquaculture										L	L	L

Lower Eel River Tributaries, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LMER-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
LMER-NCSW-1.1.1.1	Action Step	Estuary	Implement conservation easements or land acquisitions that would allow for the removal or modification of tide gates and levees in order to restore the tidal prism and tidal wetlands.	1	25	CDFW, Corps, NOAA RC, Private Landowners, RWQCB	
LMER-NCSW-1.1.1.2	Action Step	Estuary	The impact of property subdivision on streams of Lower Eel River Basin should be minimized through the use of better land management practices. (CDFW-CWPAP 2013).	2	10	CDFW, Humboldt County, Private Landowners	
LMER-NCSW-1.1.1.3	Action Step	Estuary	Work with recovery partners to improve educational outreach to community (CDFW-CWPAP, 2013). This could include targeted workshops, informational signage and materials, etc.	3	10	CDFW, Humboldt County, NMFS, NOAA RC, Tribes	
LMER-NCSW-1.1.1.4	Action Step	Estuary	Encourage and partner with Fortuna Creeks Project's urban stream clean-up, habitat restoration and monitoring (CDFW-CWPAP, 2013).	3	10	Fortuna Creek Project	
LMER-NCSW-1.1.1.5	Action Step	Estuary	Conduct habitat and fish inventories on urban streams of the Middle Subbasin, including Palmer, Jameson, and Rohner Creeks and unnamed tributaries to Strongs Creek (CDFW-CWPAP, 2013).	3	5	CDFW, Humboldt County, Local Agencies	
LMER-NCSW-1.1.2	Recovery Action	Estuary	Reduce turbidity and suspended sediment				
LMER-NCSW-1.1.2.1	Action Step	Estuary	Work to restore natural functioning tidal and drainage patterns within McNulty Slough and the Salt river.	1	10	CDFW, Corps, Farm Bureau, Humboldt County, NOAA RC, Private Landowners, RWQCB	
LMER-NCSW-1.1.2.2	Action Step	Estuary	Increase the tidal prism to help to maintain existing channels and help remove excessive fine sediment accumulation (CDFW-CWPAP, 2013).	1	25	CDFW, NMFS, NOAA RC, Private Landowners	
LMER-NCSW-1.1.2.3	Action Step	Estuary	Conduct an inventory of tide gates and levees in the watershed (CDFW-CWPAP, 2013).	2	10	CDFW, NMFS, NOAA RC, Private Landowners	
LMER-NCSW-1.1.2.4	Action Step	Estuary	Conduct an upslope erosion inventory on streams in the Middle and Upper Subbasins in order to identify and map stream bank and road-related sediment sources. Sites should be prioritized and improved in order to decrease sediment contributions within the basin (CDFW-CWPAP, 2013).	3	10	CDFW, Humboldt County	
LMER-NCSW-1.1.2.5	Action Step	Estuary	In streams where spawning area is limited, projects should be designed to trap and sort spawning gravels in order to expand and enhance redd distribution (CDFW-CWPAP, 2013).	2	25	CDFW	
LMER-NCSW-1.1.2.6	Action Step	Estuary	Water quality data, including temperature and dissolved oxygen, should be consistently collected throughout the year, for several years, in order to accurately characterize conditions in the streams. Salinities should be collected in the estuary and upstream to determine the extent of brackish conditions (CDFW-CWPAP, 2013).	2	5	CDFW	
LMER-NCSW-1.1.3	Recovery Action	Estuary	Reduce toxicity and pollutants				
LMER-NCSW-1.1.3.1	Action Step	Estuary	Livestock management fencing should be placed in areas where cattle have unrestricted access to streams (CDFW-CWPAP 2013).	2	10	CDFW, Humboldt County, NMFS, NOAA RC, Private Landowners	
LMER-NCSW-1.1.4	Recovery Action	Estuary	Improve the quality of the estuarine habitat zones				
LMER-NCSW-1.1.4.1	Action Step	Estuary	Identify, prioritize, and implement locations within the delta where vegetation can be returned to salt tolerant species, thus increasing salt marsh around slough channels and providing a buffer to adjacent lands during inundation (CDFW-CWPAP, 2013).	2	5	CDFW, Humboldt County, NOAA RC	
LMER-NCSW-1.1.4.2	Action Step	Estuary	Programs to increase riparian vegetation should be implemented in streams where shade canopy is below target values of 80% coverage. Additionally, where vegetated with exotic species, it should be considered for native plant restoration (CDFW-CWPAP, 2013).	2	20	CDFW, Humboldt County	
LMER-NCSW-1.1.5	Recovery Action	Estuary	Increase and enhance habitat complexity features				
LMER-NCSW-1.1.5.1	Action Step	Estuary	In creeks where fish spawning and rearing habitat is limited, pool enhancement and instream structures should be added to increase complexity (CDFW-CWPAP, 2013).	2	10	CDFW	
LMER-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Lower Eel River Tributaries, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LMER-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
LMER-NCSW-5.1.1.1	Action Step	Passage	Where necessary, identify barriers to fish migration in the form of large debris accumulations, culverts, etc. and modify them.	1	5	CDFW, Humboldt County, NMFS	
LMER-NCSW-5.1.1.2	Action Step	Passage	Remove tidegates on the Salt River, and improve passage on Reas, Francis, Barber, and Coffee creeks.	2	10	CDFW, Farm Bureau, Humboldt County, Private Landowners, RWQCB	
LMER-NCSW-5.1.1.3	Action Step	Passage	Implement passage improvements on Strongs Creek (6 locations) and on Rohner Creek at Rohnerville Road.	2	6	CDFW, City of Fortuna, NOAA RC	
LMER-NCSW-5.1.1.4	Action Step	Passage	Assess passage barriers along Highway 101 and implement improvement on small tributaries though out the North Coastal stratum.	2	10	CDFW, NOAA RC, Private Landowners	
LMER-NCSW-5.1.1.5	Action Step	Passage	Improve passage at Stitz, Darnel, Panther, Allen, and Weber creeks.	2	5	Caltrans, CDFW, Humboldt Redwood Company, NOAA RC	
LMER-NCSW-5.1.1.6	Action Step	Passage	Implement passage improvements on Chadd Creek at Highway 254 and Holmes Flat Road.	2	1	Caltrans, CDFW, NOAA RC	
LMER-NCSW-5.1.1.7	Action Step	Passage	Evaluate and prescribe solution for perched sediment at the mouth of Dean Creek to improve fish passage.	2	1	CDFW, NOAA RC, Private Landowners	
LMER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
LMER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Use CDFW, Coastal Watershed Program results, or other credible habitat assessments to improve shelter, pool frequency, and LWD across tributaries in this stratum.	2	10	CDFW, NOAA RC, Private Landowners	
LMER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions identified in habitat assessments to improve habitat complexity.	2	10	CDFW, NOAA RC, Private Landowners	
LMER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
LMER-NCSW-7.1.1.1	Action Step	Riparian	Where feasible, restore or improve the width of riparian zone with native vegetation along the banks of the Eel River, McNulty and other sloughs, and the Salt River basin.	2	20	CDFW, Humboldt County, NOAA RC, Private Landowners	
LMER-NCSW-7.1.1.2	Action Step	Riparian	Identify potential reaches in Rohner and Strongs creeks for riparian restoration.	3	2	CDFW, City of Fortuna, NOAA RC, Private Landowners	
LMER-NCSW-7.1.1.3	Action Step	Riparian	Land managers of tributaries along the lower Eel River from Howe Creek to Perrott Creek should maintain or establish riparian zones to protect canopy, LWD recruitment and stream bank stabilization.	2	25	CalFire, Private Landowners	
LMER-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
LMER-NCSW-8.1.1.1	Action Step	Sediment	Complete a comprehensive sediment source inventory and assessment for tributaries in this stratum. First priority should be streams with poor substrate ratings such as Westfork Howe Nanning, Dean, and Atwell creeks. .	2	4	CalFire, CDFW, NMFS, Private Landowners	
LMER-NCSW-8.1.1.2	Action Step	Sediment	Implement actions identified in sediment source assessments to improve habitat.	2	10	CalFire, CDFW, NOAA RC	
LMER-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-10.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants				
LMER-NCSW-10.1.1.1	Action Step	Water Quality	Improve water quality in the Salt River basin by controlling sediment and improving riparian habitat.	2		CDFW, City of Ferndale, NMFS, RWQCB	
LMER-NCSW-10.1.1.2	Action Step	Water Quality	Improve coordinated planning efforts concerning drainage, wastewater treatment and development with the City of Ferndale.	3	20	CDFW, City of Ferndale, NMFS, RWQCB	
LMER-NCSW-10.1.1.3	Action Step	Water Quality	Implement the Ferndale Drainage Master Plan.	2	20	CDFW, City of Ferndale, NMFS, Private Landowners, Public, RWQCB	
LMER-NCSW-10.1.1.4	Action Step	Water Quality	Obtain compliance with NPDES standards for water quality at the Ferndale Wastewater Treatment Plant.	2	20	City of Ferndale, RWQCB	

Lower Eel River Tributaries, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LMER-NCSW-10.1.1.5	Action Step	Water Quality	Work with recovery partners to insure that water treatment facilities in Fortuna, Loleta, Ferndale and other nearby areas do not contaminate the Eel River estuary..	2	20	Cities, Private Landowners, RWQCB	
LMER-NCSW-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
LMER-NCSW-13.1.1.1	Action Step	Channel Modification	Re-establish mainstem Salt River from river mile 5.1 to 8.3 and improve channel conditions from river mile 3.4 to 5.1 to improve drainage and allow access for salmonids.	2	10	CDFW, Humboldt County, NOAA RC, Private Landowners, RWQCB	
LMER-NCSW-13.1.1.2	Action Step	Channel Modification	Restore estuarine habitat and wetlands on the Salt River from river mile zero (confluence with Eel River) to 3.4 at Reas Creek.	2	5	CDFW, Humboldt County, NOAA RC, Private Landowners, RWQCB	
LMER-NCSW-13.1.1.3	Action Step	Channel Modification	Remove or modify tide gates and levees in the Salt River basin to improve fish passage, water quality, and channel function.	2	10	CDFW, Humboldt County, NOAA RC, Private Landowners, RWQCB	
LMER-NCSW-13.1.1.4	Action Step	Channel Modification	Utilize set back levees for the improvement of flood control, riparian function and to establish channel meander and habitat suitability in the trans delta reach of Reas Creek.	2	5	CDFW, Humboldt County, NOAA RC, Private Landowners, RWQCB	
LMER-NCSW-13.1.1.5	Action Step	Channel Modification	Use levee set backs, or levee removal to develop a wider floodplain that restores sloughs and wetlands in the North Slough channels.	2	20	CDFW, Corps, Humboldt County, NOAA RC, RWQCB	
LMER-NCSW-13.1.1.6	Action Step	Channel Modification	Implement levee removal along both sides of McNulty Slough and its tributaries, and along the west area of McNulty Slough.	2	10	CDFW, Corps, Humboldt County, NOAA RC, Private Landowners, Public, RWQCB	
LMER-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
LMER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
LMER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
LMER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Title 14, Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers to restrict fishing during low flow periods.	1	5	CDFW, NMFS	
LMER-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LMER-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
LMER-NCSW-18.1.1.1	Action Step	Livestock	Work with landowners to build exclusionary fencing to reduce impacts of cattle on stream banks, riparian zones, and water quality.	2	10	Humboldt County, NOAA RC, NRCS, Private Landowners	
LMER-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
LMER-NCSW-18.1.2.1	Action Step	Livestock	Continue to implement dairy waste reduction plans and encourage the use of best management practices for dairy waste management.	3	20	Humboldt County, Private Landowners, RWQCB	
LMER-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
LMER-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
LMER-NCSW-19.1.1.1	Action Step	Logging	Work with recovery partners through the timber harvest permitting process to minimize timber harvest actions on unstable soils.	3	25	CalFire, CDFW, NMFS, RWQCB	

Howe Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
HowC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HowC-NCSW-5.1.1	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)				
HowC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prescribe solution for perched sediment at the mouth of Howe Creek to improve fish passage.	3	1	CDFW, NOAA RC, Private Landowners	Most of these tributaries are disconnected from the mainstem during the summer months because of gravel and sediment deposits from the Eel River during high flows. Howe Creek has extreme disconnection issues and has a braided channel at the confluence with the Eel River. Some structures have been installed, but are not effective. This is a widespread problem in the lower Eel. Howe and Price Creek and potentially several other major tribs.
HowC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HowC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
HowC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Use CDFW, Coastal Watershed Program results, or other credible habitat assessments to improve shelter, pool frequency, and LWD across tributaries in this stratum.	2	10	CDFW, NOAA RC, Private Landowners	
HowC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HowC-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
HowC-NCSW-7.1.1.1	Action Step	Riparian	Identify potential reaches in Howe Creek for riparian restoration and the effectiveness of existing structures.	3	2	CDFW, City of Fortuna, NOAA RC, Private Landowners	
HowC-NCSW-7.1.1.2	Action Step	Riparian	Land managers of tributaries along the lower Eel River from Howe Creek to Perrott Creek should maintain or establish riparian zones to protect canopy, LWD recruitment and stream bank stabilization.	2	20	CalFire, Private Landowners	
HowC-NCSW-7.1.1.3	Action Step	Riparian	Riparian condition needs to be evaluated for disconnection issues from gravel sediment deposits from the mainstem during high flows.	2	20	NGO	Most of these tributaries are disconnected from the mainstem during the summer months because of gravel and sediment deposits from the Eel River during high flows. Howe Creek has extreme disconnection issues and has a braided channel at the confluence with the Eel River. Some structures have been installed, but are not effective. This is a widespread problem in the lower Eel. Howe and Price Creek and potentially several other major tributaries.
HowC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HowC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
HowC-NCSW-8.1.1.1	Action Step	Sediment	Complete a sediment source assessment in Howe creek and its tributaries to determine high priority sites for treatment.		2	CalFire, NMFS, Private Landowners, RWQCB	
HowC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
HowC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
HowC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
HowC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Title 14, Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers to restrict fishing during low flow periods.	1	5	CDFW, NMFS	

Howe Creek, Northern California Steelhead (Northern Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
HowC-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
HowC-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
HowC-NCSW-18.1.1.1	Action Step	Livestock	Assess grazing impact on riparian condition, identifying opportunities for improvement.	3		CDFW, Humboldt County, Private Landowners	
HowC-NCSW-18.1.1.2	Action Step	Livestock	Work with landowners to build exclusionary fencing to reduce impacts of cattle on stream banks, riparian zones, and water quality.	2	10	Humboldt County, NOAA RC, NRCS, Private Landowners	
HowC-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
HowC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
HowC-NCSW-19.1.1.1	Action Step	Logging	Work with CalFire and CDFW through the timber harvest permitting process to minimize timber harvest actions on unstable soils in the headwater areas of Howe Creek and its tributaries.	3	25	CalFire, CDFW, NMFS	

North Mountain Interior Diversity Stratum

This stratum includes populations of winter steelhead that spawn in watersheds that drain relatively high elevation mountains in the Klamath Mountains ecoregion, many of which attain sufficiently high elevations for snowmelt to contribute significantly to the annual hydrograph. Most of these watersheds lie north of the mainstem Eel River. Included in this stratum are larger and minor mainstem tributaries of the Eel River whose watersheds include relatively high elevation mountains.

The populations that have been selected for recovery scenarios are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum. Although Redwood Creek and Mad River cross two diversity strata and were broken into an upper and lower populations, there was only one profile, results and recovery actions developed for the upper and lower populations. These are found in the Northern Coastal Diversity Stratum section of this Recovery Plan. Dobbyn Creek is found in the Rapid Assessment that was done for the Lower Interior/North Mountain Interior Diversity Strata and located in the North Mountain Interior Diversity section of this Recovery Plan.

- Larabee Creek
- Mad River (Upper)* See Northern Coastal Diversity Stratum
- Middle Fork Eel River
- North Fork Eel River
- Redwood Creek (Humboldt Co.) (Upper)* See Northern Coastal Diversity Stratum
- Upper Mainstem Eel River
- Van Duzen River
- Lower Interior/North Mountain Interior Rapid Assessment
    - Dobbyn Creek (See Lower Interior Diversity Stratum)

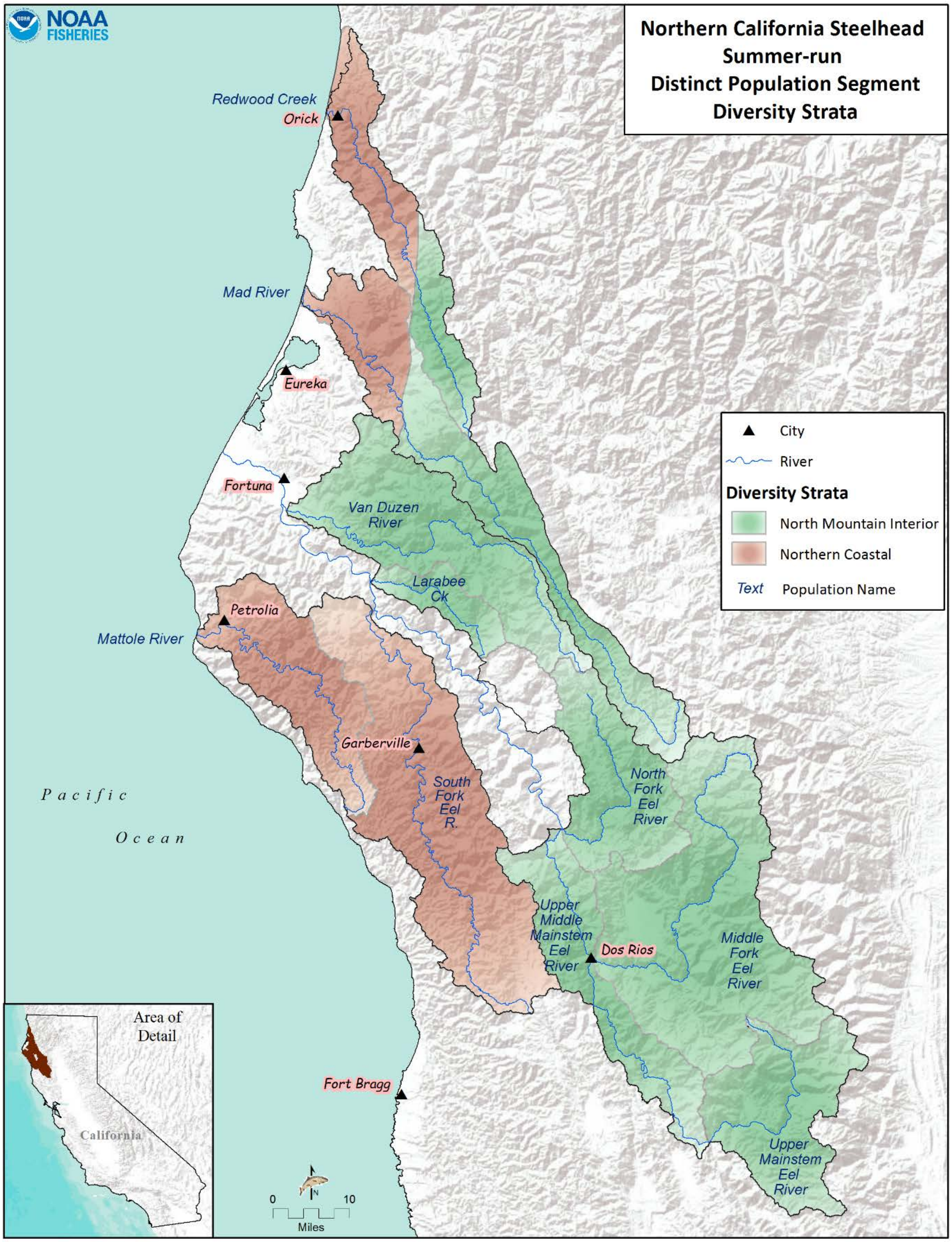
NC steelhead North Mountain Interior Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting. Redwood Creek and Mad River cross two diversity strata and were broken into an upper and lower to reflect this.

Diversity Stratum	NC steelhead Populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
North Mountain Interior	Dobbyn Creek	I	Supporting	47.0	6-12	280-562
	Larabee Creek	I	Essential	86.4	30.2	2,600
	Mad River (Upper)*	I	Essential	289.6	20.0	5,800
	Middle Fork Eel River	I	Essential	472.4	20.0	9,400
	North Fork Eel River	I	Essential	315.7	20.0	6,300
	Redwood Creek (Humboldt Co) (Upper)*	I	Essential	86.2	30.2	2,600
	Upper Mainstem Eel River	I	Essential	317.5	20.0	6,400
	Van Duzen River	I	Essential	312.2	20.0	6,200
	North Mountain Interior Diversity Stratum Recovery Target					**39,300**

NC summer-run steelhead: Diversity Strata, Populations, Historical Population Status, Effective Population Size (N_e). *Although Redwood Creek and Mad River span two diversity strata because so little is known about the population and where they are occurring, they will be treated as one population until more information is gained from monitoring.

Diversity Strata	NC summer-run steelhead populations	Historical Population Status	Effective Population Size
Northern Coastal/ North Mountain Interior	Redwood Creek*	I	$N_e \geq 500$
Northern Coastal/ North Mountain Interior	Mad River*	I	$N_e \geq 500$
North Mountain Interior	Van Duzen River	I	$N_e \geq 500$
North Mountain Interior	Larabee Creek	I	$N_e \geq 500$
North Mountain Interior	North Fork Eel River	I	$N_e \geq 500$
North Mountain Interior	Upper Middle Mainstem	I	$N_e \geq 500$
North Mountain Interior	Middle Fork Eel River	I	$N_e \geq 500$
North Mountain Interior	Upper Mainstem Eel River	I	$N_e \geq 500$

NC Winter-Run Steelhead North Mountain Interior Diversity Stratum



NC Summer-Run Steelhead Northern Coastal and North Mountain Interior Diversity Strata

Larabee Creek Population

NC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 2,600 adults
- Current Intrinsic Population: 86.4 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: NA

For information regarding CC Chinook Salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Historical steelhead abundance estimates for Larabee Creek are lacking, but insight as to how prolific the anadromous salmonid runs were at the start of European settlement within the watershed may be gleaned from early fishing records at the mouth of the Eel River (Yoshiyama and Moyle 2010). Given the amount of habitat available historically within Larabee Creek, steelhead runs likely numbered in the thousands prior to the habitat degradation and overfishing that began during the latter 19th century.

The Larabee Creek adult steelhead run was estimated at 2,000 adult fish during 1978 (Becker and Reining 2009). Steelhead are distributed throughout the population area up to natural barriers to anadromy (PALCO 2007). A long-standing road-crossing barrier exists on Chris Creek, the lowermost tributary to Larabee Creek.

History of Land Use

Historically, the Larabee Creek watershed contained primarily late-seral redwood/Douglas-fir (coniferous) forests, with limited open oak woodland/prairies farther inland at higher elevations (PALCO 2007). The first logging activities occurred in the 1900s and 1910s in the floodplain areas of lower Larabee Creek where timber was large and easily accessible (PALCO 2007). More than 60 percent of the lower Larabee Creek area, including significant portions of the Chris, Carson, Smith, Balcom, Dauphiny, Scott, and Arnold creek drainages, were logged by the end of the 1920s (PALCO 2007). Following the initial logging, technological developments after World War II enabled logging and road building in steeper, more landslide prone areas, which caused excessive sediment delivery to streams. Massive erosion and instream sedimentation occurred following large floods in 1955 and 1964, filling in pools and widening stream channels. The remainder of the old-growth timber in the Larabee Creek watershed was harvested by the 1980s, and second-growth logging activities have occurred since then (PALCO 2007). After settlement by ranchers in the early 1900s, the lower Larabee Creek area was burned repeatedly for cattle grazing (PALCO 2007).

Current Resources and Land Management

Ninety-nine percent of the Larabee Creek watershed is under private ownership, with much of the lower one-third of the watershed actively managed for timber production by the Humboldt Redwood Company (HRC; formerly PALCO). Timber holdings owned by HRC are managed according a Habitat Conservation Plan (HCP) that seeks to minimize adverse effects to aquatic and terrestrial habitat during timberland operations. The goals of the HRC HCP include trending towards properly functioning aquatic conditions and reducing sediment input by upgrading 1,500 miles of roads on their timberlands (HRC 2012). Other land uses occurring within the Larabee Creek watershed include rural residential, agriculture, and livestock grazing. There are several active watershed groups in the area: the Eel River Watershed Improvement Group, Friends of the Eel River, and the Eel River Recovery Project. The following are pertinent reports or plans for Larabee Creek:

- Humboldt Redwood Company HCP (HRC 2012);
- HRC Watershed Analyses for: Lower Eel/Eel Delta and Upper Eel (PALCO 2007);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997); and
- Lower Eel River Total Maximum Daily Loads for Temperature and Sediment (USEPA 2007).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for steelhead: shelter rating, canopy cover, streamside road density, aquatic invertebrates, estuary quality and extent, water temperature, timber harvest, and riparian tree diameter. Recovery strategies will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Larabee Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Viability: Density, Abundance, and Spatial Structure

Based on population abundance and trend data from other Eel River sub-basins (e.g., SF Eel, Upper Eel), the abundance of steelhead in Larabee Creek is likely well below low-risk abundance targets and is therefore likely limiting their ability to successfully reproduce and increase in abundance (e.g., depensatory effects). However, habitat conditions are improving in many areas and are currently adequate for steelhead to successfully complete their freshwater life history. Restoration of degraded habitat, combined with improved land management, should allow the Larabee Creek steelhead population to increase in abundance.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of all Eel River salmonid populations. The Eel River estuary is severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Habitat Complexity: Large Wood and Shelter

Habitat Complexity: Shelter conditions are rated Poor for summer rearing juveniles and large wood frequency is rated Fair for all life stages. PALCO (2007) determined tree size resulting from young forest stands is currently the limiting factor for recruitment of functional large wood in the management unit that includes lower Larabee Creek. However, PALCO (2007) concluded that nearly 90 percent of the riparian forests in the management unit will meet or exceed riparian composition goals within 40 years.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediment conditions have an overall Fair rating for adults, eggs, and summer and winter rearing juvenile steelhead. Embeddedness levels are high within Larabee Creek tributaries and the upper mainstem (PALCO 2007). Suitable spawning gravel exists in some areas within the watershed but other areas are still impaired (*e.g.,* excess fine sediments) from past land use. Impaired gravel quality may reduce macro-invertebrate production that supports rearing salmonids. Threats contributing to this condition include Logging and Wood Harvesting and Roads and Railroads.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Pool complexity and pool: riffle ratios are rated Fair for adults and summer and winter rearing salmonids. PALCO (2007) determined pool complexity and pool: riffle ratio metrics for Larabee Creek mostly met properly functioning conditions, although distinct differences were observed between streams sampled in the lower watershed (Wildcat geology) versus upper watershed sites (Yager geology). Average pool depths are typically greater than 3 feet in the mainstem; however, tributary pools are much shallower averaging only 1.5 feet (PALCO 2007). These conditions primarily affect summer rearing juvenile steelhead. Due to contribution of fine sediment, the primary threats contributing to this condition are Logging and Wood Harvesting and Roads and Railroads.

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian Vegetation conditions have an overall Fair rating for the watershed processes in the Larabee Creek population area. Where data exist, streamside canopy cover shows a range of conditions, with some good to very good conditions (70 percent to 100 percent shade) in tributaries, and poor cover and shade conditions in the mainstem channel. For instance, over half of the channel length of lower Larabee Creek has less than 20 percent canopy cover. Even where streamside canopy cover is good, such as in first and second order channels of many Larabee Creek tributaries, riparian areas consist predominantly of hardwood species and immature conifers that are not yet of size to effectively function as LWD (PALCO 2007). The primary threat contributing to this condition is Logging and Wood Harvesting.

Sediment Transport: Road Density

Sediment transport caused by road density conditions have an overall Poor rating for the watershed processes in the Larabee Creek population area. The Eel River watershed is one of the most naturally erosive watersheds in the United States (Brown and Ritter 1971) because of the highly active tectonic setting, highly erodible soils in the area, and high precipitation. Anthropogenic activities in Larabee Creek such as road building have exacerbated these naturally high sediment loads (USEPA 2007). Most subwatersheds in the Larabee Creek basin exhibit road densities much higher than 3 road miles per square mile of land, with up to 7.8 road miles per square mile in the mid-Larabee subcomplex of tributaries (PALCO 2007).

Landscape Patterns: Timber Harvest

Major legacy and current landscape disturbance within Larabee Creek, primarily associated with timber harvest and associated road building results in a rating of Poor for Timber Harvest on watershed processes.

Water Quality: Temperature

High water temperatures are stressful for summer rearing steelhead. The Larabee Creek watershed is listed as impaired for elevated temperature under section 303(d) of the Clean Water Act. Summer water temperatures in mainstem Larabee Creek approach lethal levels (USEPA 2007), which severely limits the amount of habitat available to rearing steelhead. Solar warming of pools occurs in the lower mainstem due to poor riparian cover and high sediment loads that decrease pool depth. As mentioned earlier, many Larabee Creek tributaries exhibit suitable levels of canopy cover, and therefore have water temperatures that support juvenile steelhead rearing (PALCO 2007).

Very Good or Good Current Conditions

Floodplain connectivity condition is rated Good for juveniles, smolts, and adults. Floodplains in Larabee Creek were determined to be fully functional (PALCO 2007), but excessive sediment loads and dysfunctional riparian processes (*i.e.*, poor LWD recruitment) in the mainstem Eel River below the confluence with Larabee Creek, and levees in the Eel River estuary limit floodplain access for Larabee Creek salmonids during outmigration. Barriers to fish passage do not present a major impediment to recovery of steelhead in Larabee Creek, although a long-standing road-crossing barrier on Chris Creek and log-jams in several tributaries are believed to partially impede adult passage.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Larabee Creek CAP results). Recovery strategies will likely focus on ameliorating High and Very High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Larabee Creek CAP results.

Roads and Railroads

Roads constitute a High threat to summer rearing juvenile steelhead, and a High threat to watershed processes. Most subwatersheds in the Larabee Creek basin exhibit road densities much higher than 3 road miles per square mile of watershed, with up to 7.78 road miles per square mile in the mid-Larabee subcomplex of tributaries (PALCO 2007). Road storm proofing, reconstruction, and upgrading have occurred on a significant portion of HRC's roads (PALCO 2007) and will continue to occur under the HCP.

Logging and Wood Harvesting

Logging and Wood Harvesting is a High threat to watershed processes. Many of the changes that have occurred to instream and riparian conditions in Larabee Creek reflect legacy effects of more intensive harvest from previous decades. In the future, given the percentage of the watershed that is actively managed as timberland, and that most of the watershed has been logged in the past, continuing harvest on these areas will likely continue to affect habitat downstream by introducing more sediment than would occur naturally.

Channel Modification

Channel modification is rated as a High threat for smolts. Channel modification is not pervasive in Larabee Creek, but the Eel River estuary and mainstem have been significantly channelized by dikes and levees and subsequent filling for ranching or livestock purposes. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Disease, Predation and Competition

Competition and predation from non-native Sacramento pikeminnow (predation and competition) and California roach (competition) pose a High stress to summer rearing steelhead. These non-native species have the greatest impact in wide, low gradient mainstem reaches where degraded instream habitat and water quality conditions favor their production over indigenous steelhead and increase the risk of predation by Sacramento pikeminnow.

Fishing and Collecting

Fishing and Collecting is rated a High threat to winter adult steelhead. Although the fishery is catch-and-release only, the activity attracts hundreds, if not thousands, of anglers every season. Regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration. Currently, sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1 of each year and expires on January 31, which allows anglers to target steelhead staging in low flow conditions throughout September or after January. Adults are easy targets for both fisherman and poachers in these extremely low flows. Poor water quality in September contributes to the stress and likely results in increased hook-and-release mortalities (Clark and Gibbons 1991).

NMFS has determined that the effects of Pacific coast ocean salmon fisheries conducted under the Pacific Fishery Management Plan and U.S. Fraser Panel salmon fisheries in Northern Puget Sound conducted under the Pacific Salmon Treaty are "not likely to adversely affect" listed steelhead species because steelhead are only occasionally encountered and it would be impossible to measure or detect potential effects of the proposed action on those species (NMFS 2001).

Low or Medium Rated Threats

Less than one percent of the Larabee Creek population area is currently used for agriculture, and residential development is sparse and low in density; therefore, these threats are a Low to Medium threat. Although there are few diversions in the population area, any diversion or groundwater pumping in the summer exacerbates already stressful rearing conditions for steelhead, and is therefore considered Medium stress to rearing lifestages. Fuel management and fire suppression is a Medium threat because it may increase the potential for a catastrophic fire in the future, particularly in the interior portion of the watershed.

Currently, the extent of marijuana production in the Larabee Creek drainage is unknown; however it is likely to be increasing as it has in other sub-watersheds throughout the Eel River system. The potential implications of expanding marijuana production on stream flow quantity and quality and habitat availability in the Larabee Creek drainage should be assessed.

Limiting Stresses, Lifestages, and Habitats

Summer rearing steelhead productivity is likely limiting subsequent adult abundance within the Larabee Creek watershed. Inadequate stream shading, high water temperatures, impaired gravel quality (spawning and benthic food productivity), and reduced habitat complexity have reduced the quality and extent of rearing habitat.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Larabee Creek steelhead population is discussed below with more detailed and site-specific recovery actions provided in Larabee Creek CAP Results, which provides the Implementation Schedule for this population.

Improve Riparian Habitat Function and Composition

Increase the quality and quantity of riparian vegetation through appropriate silvicultural prescriptions such as thinning (for release of conifers) and planting. Reestablishment of coniferous forests in the lower mainstem floodplain will improve canopy cover and instream temperatures.

Increase Habitat Complexity

Pools in Larabee Creek and mainstem Eel River are too simplified and shallow to adequately support juvenile steelhead growth and survival. Large wood, boulders, or other instream structure should be added in proximity to cool water refugia in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be re-created in the low-gradient areas of the population area, as well as the lower mainstem Eel River.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor steelhead habitat. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance which minimizes effects on salmonid habitat should be developed for building and maintenance of private roads.

Reduce Abundance of Sacramento Pikeminnow

Explore how best to reduce the abundance of the Sacramento pikeminnow population. Provide increased refugia habitat for salmonids through the creation of cool and complex habitats, and make habitat less suitable for pikeminnow by managing to reduce water temperature.

Improve Passage

Assess passage at logjam barriers in tributaries and provide passage if feasible. Remove the road crossing barrier on Larabee Ranch (Chris Creek).

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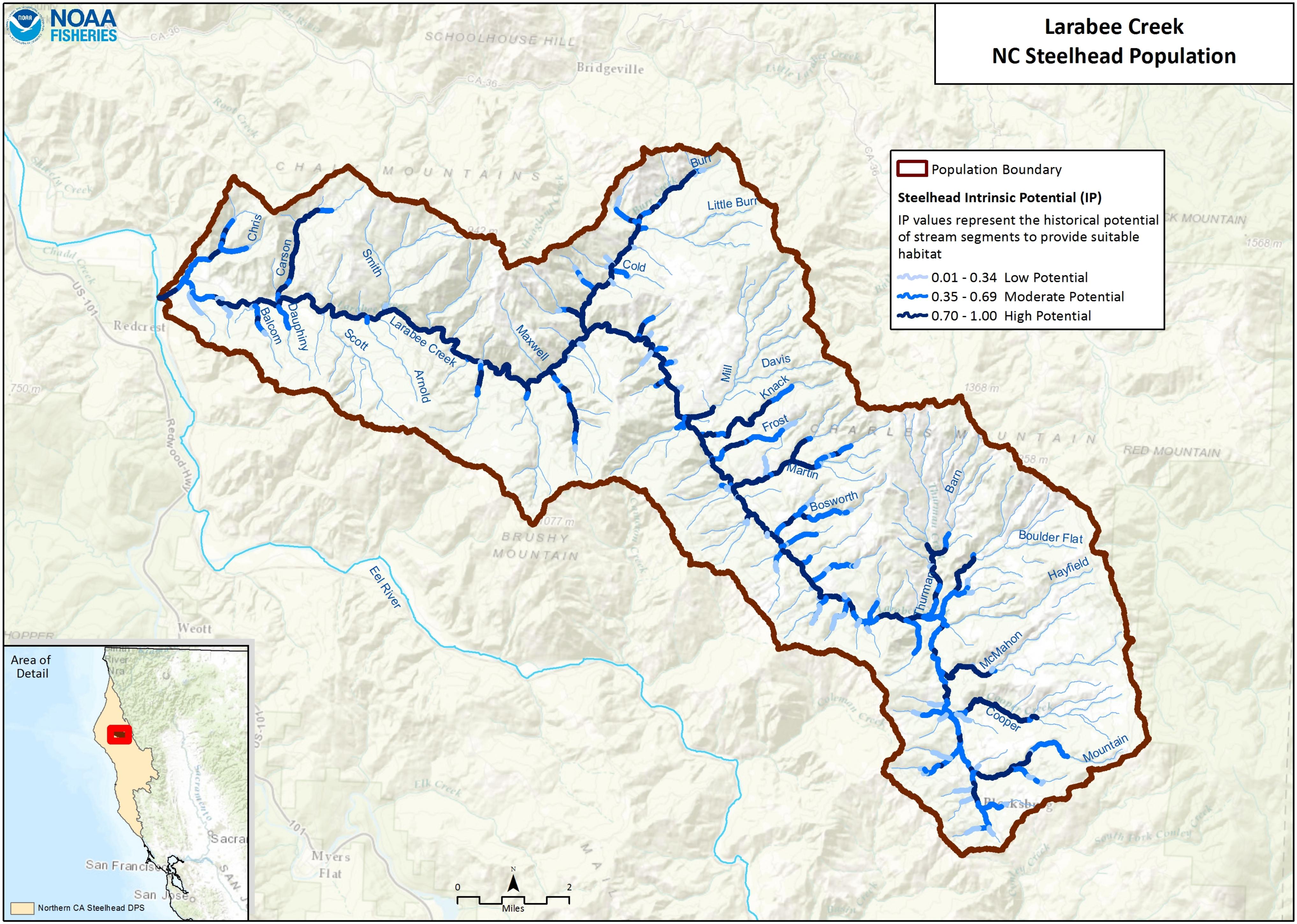
Larabee Creek
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Chris
Carson
Smith
Balcom
Dauphiny
Scott
Larabee Creek
Arnold
Maxwell
Burr
Little Burr
Cold
Mill
Davis
Knack
Frost
Martin
Bosworth
Barn
Thurman
Boulder Flat
Hayfield
McMahon
Cooper
Mountain
Eel River
Bridgeville
Redcrest
Weott
Myers Flat
SCHOOLHOUSE HILL
BRUSHY MOUNTAIN
RED MOUNTAIN
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
0
2
Miles

NC Steelhead Larabee Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	93.71% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	34.69% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>88.4 < 1768 = >1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 33	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	13.5% (0.85mm) and <30% (6.4mm)	Good
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	59 to 80% depending on report of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair

Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	Fair
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Fair
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	93.71% of IP-km	Very Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	45% of streams/ IP-Km (>70% average stream canopy)	Poor
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	34.69% Class 5 & 6 across IP-km	Poor
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good

			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	34.62% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	93.71% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	34.69% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		>8840<176800 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.03% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	10-19% of Watershed in Agriculture	Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	44.22% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	6.83 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.01 Miles/Square Mile	Poor

NC Steelhead Larabee Creek CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Medium	Low	Medium
2	Channel Modification	Low	Low	Medium	Medium	High	Low	Medium
3	Disease, Predation and Competition	Low		High	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Medium	Medium
5	Fishing and Collecting	High		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Low	Medium
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Medium	High	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	High	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Low	Medium	Low	Low	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium

Larabee Creek, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LarbC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LarbC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
LarbC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	2	1	CDFW, NGO, NMFS	
LarbC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows to re-connect the floodplain, guided by assessment.	2	10	CDFW, NGO, NMFS	
LarbC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LarbC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
LarbC-NCSW-5.1.1.1	Action Step	Passage	Remove road crossing barrier on Larabee Ranch.	2	1	CDFW, NMFS, Private Landowners	
LarbC-NCSW-5.1.1.2	Action Step	Passage	Assess passage at logjam barriers in tributaries and provide passage if feasible.	2	5	CDFW, NMFS, Private Landowners	
LarbC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LarbC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
LarbC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	1	CDFW	Mainstem Larabee Creek and lower tributaries.
LarbC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Place LWD, boulders, or other instream structure, guided by assessment.	2	5	CDFW	Mainstem Larabee Creek and lower tributaries.
LarbC-NCSW-7.1	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
LarbC-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
LarbC-NCSW-7.1.1.1	Action Step	Riparian	Reduce detrimental environmental impacts of conversion of TPZ land to other uses.	2	10	BOF, Calfire, NMFS	Action is considered in-kind
LarbC-NCSW-7.1.1.2	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	10	BOF, Calfire, NMFS	Action is considered in-kind
LarbC-NCSW-7.1.1.3	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	10	BOF, Calfire, NMFS	Action is considered in-kind
LarbC-NCSW-7.1.1.4	Action Step	Riparian	Work to ensure effects of activities on converted areas are minimized.	2	10	BOF, Calfire, NMFS	Action is considered in-kind
LarbC-NCSW-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LarbC-NCSW-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
LarbC-NCSW-14.1.1.1	Action Step	Disease/Predation/Competition	Conduct studies to determine distribution and habitat preferences of pikeminnow in the Eel River basin.	3	5	CDFW	
LarbC-NCSW-14.1.1.2	Action Step	Disease/Predation/Competition	Conduct studies to determine how competition with pikeminnow alters the natural behavior and survival of juvenile salmonids.	3	5	CDFW	
LarbC-NCSW-14.1.1.3	Action Step	Disease/Predation/Competition	Assess feasibility and benefits of various methods to eradicate or suppress Sacramento pikeminnow, including genetic technology methods (e.g., deleterious genes).	3	5	CDFW	
LarbC-NCSW-14.1.1.4	Action Step	Disease/Predation/Competition	Take measures to eradicate or suppress fish species using genetic technology or other methods identified as feasible.	3	25	CDFW	
LarbC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
LarbC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
LarbC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	1	5	CDFW, NMFS	

Larabee Creek, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
LarbC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Title 14, Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers to restrict fishing during low flow periods.	1	5	CDFW, NMFS	
LarbC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LarbC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
LarbC-NCSW-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription for benefits to listed salmonids.	3	1	BOF, Calfire, NMFS, Private Landowners, Timber	Lower mainstem Larabee Creek.
LarbC-NCSW-19.1.1.2	Action Step	Logging	Thin, or release conifers, guided by prescription.	3	10	BOF, Calfire, NMFS, Private Landowners, Timber	Lower mainstem Larabee Creek.
LarbC-NCSW-19.1.1.3	Action Step	Logging	Plant conifers, guided by prescription.	2	10	BOF, Calfire, NMFS, Private Landowners, Timber	Lower mainstem Larabee Creek. Costs will vary depending on methods implemented and extent of rehabilitation. Cost for riparian planting estimated at $20,719/acre and estimated for 10 acres for a total of $207,190.
LarbC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
LarbC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
LarbC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	2	1	CalFire, CDFW, Private Landowners, Timber	
LarbC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	2	10	CalFire, CDFW, Private Landowners, Timber	
LarbC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	2	10	CalFire, CDFW, Private Landowners, Timber	
LarbC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	25	CalFire, CDFW, Private Landowners, Timber	
LarbC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
LarbC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams etc.)				
LarbC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance which minimizes effects of road maintenance and construction on salmonid habitat.	2	1	County	Action is considered In-Kind

Middle Fork Eel River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 9,400 adults
- Current Intrinsic Population: 472.4 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: NA

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The historical population abundance of adult steelhead in the Middle Fork Eel River was estimated to be 17,000 spawners, which includes about 2,000 summer steelhead (CDFG 1966). An earlier abundance estimate for the summer run population reported in Jones (Jones 1992) was made by hikers in the mid-1930s, which estimated summer steelhead at 6,000 adult fish. Currently, the Middle Fork Eel River population of summer steelhead is the largest in California, where annual counts between 1966 and 2003 have ranged from 196 to 1601 adult fish (Harris 2002). The most recent estimate for summer steelhead in the Middle Fork Eel was 523 in 2010 (S. Harris, CDFW, personal communication, 2010). No current abundance estimate is available for the winter run population in the Middle Fork Eel River.

Limited juvenile steelhead distribution surveys have been conducted by CDFW and other agencies in this basin. Existing habitat typing surveys and other stock assessment surveys as recent as 2009 show presence of juvenile steelhead in most tributaries, and the upper reaches of the Middle Fork Eel River. The lower 25 miles of the mainstem below the confluence of the Black Butte River has historically had elevated stream temperatures and limited presence of salmonids during the summer months (CDWR 1965). When current steelhead distribution is compared to the potential historic habitat proposed by Spence *et al.* (2008), the current juvenile distribution occurs in about 50 to 75 percent of the potential historic habitat. No current abundance estimates are available for adult winter steelhead or smolts in this watershed.

Areas of higher quality habitat in this basin are located in the upper reaches of Black Butte River and its tributaries such as Estell Creek. Medium quality habitat exists in stream reaches of Williams Creek, and the upper Middle Fork Eel River and its tributaries.

History of Land Use

The first human inhabitants of the Middle Fork Eel watershed were the Yuki Indians which populated the lower elevations in the winter, and moved to the higher elevations in the summer to hunt and fish. In 1870, the Round Valley Reservation was established where Yuki, Wylaki, and another 5,000 people from 14 Indian tribes were brought onto the reservation (Eargle 1986).

The first extensive land use occurred in the Middle Fork Eel River watershed in the late 1800s and early 1900s with severe overgrazing in some areas (USEPA 2003). Logging activities began around 1860 near Covelo, continuing until after World War II, when private lands were extensively cut and burned. The harvest of public lands of Mendocino National Forest began in 1958. It is estimated that 46 percent of the timberland in the basin (23 percent of the watershed) was logged by either clear cut or partial cut from 1950 – 1981 (CDWR 1982).

The U.S. Environmental Protection Agency (EPA) has categorized the drainage as sediment and temperature impaired due to unstable geology and damage from the 1964 flood. The primary cause of today's higher sedimentation rates are attributed to the effects of the 1964 flood which were exacerbated by poor land management activities in the basin. Reports by CDFW after the 1964 flood describe the deep pools used by summer steelhead filled with 10 to 40 feet of sediment (Jones 1992). Since the mid-1970s the USFS has reported recovery of channel conditions in the upper reaches of the Middle Fork Eel River, noting that aerial photos show that areas look the same in 1993 as they did in 1961 (USEPA 2003). Other subbasins such as the Black Butte River have not recovered at the same rate as the upper Middle Fork Eel River, with lower reaches continuing to show effects of aggradation from the 1964 flood (USEPA 2003).

Current Resources and Land Management

The Middle Fork Eel River watershed encompasses an area of 753 square miles (482,000 acres), and is mixed in ownership with 51 percent Federally managed (USFS and BLM), 4 percent in the Round Valley Indian Reservation, and 45 percent in private holdings. There are two wilderness areas managed by the USFS, the Yolla Bolly (approximately 150,000 acres) and the Yuki Wilderness area which encompasses 53,887 acres. The USFS manages the majority of the upper watershed in the Middle Fork Eel River and Black Butte River under the Land and Resource Management Plan (LRMP) for the Mendocino National Forest. The Round Valley Indian Tribe (RVIT) manages their portion of the watershed under a Resource Management Plan. Both the USFS and RVIT are currently involved in restoration actions that include road upgrades/decommissioning and stream restoration in Mill Creek by the RVIT, near the town of Covelo.

Private lands are characterized by large ranches, smaller private ownerships and some private industrial timberland. The Round Valley area is an interior valley consisting of pasture land and a population of about 2,000 residents which includes some tribal lands mixed with private ownerships around the town of Covelo.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, riparian tree diameter, shelter rating, primary pool frequency, and pool riffle ratio for adults and juvenile lifestages. Gravel embeddedness was rated Poor for the egg lifestage and food production for juvenile fish. The only indicator for watershed process that was rated as Poor through the CAP analysis was road density within riparian areas. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes. Indicators that are rated as Fair through the CAP process, but are considered important within specific areas of the watershed include baseflow, canopy cover, and toxicity of tributary streams during the juvenile rearing period.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Middle Fork Eel River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Suitable shelter ratings are required for juvenile salmonids as well as adult spawners for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. Data from CDFW habitat inventories indicate shelter ratings throughout the Middle Fork Eel River and its tributaries are poor with 40 percent of the potential habitat meeting suitability targets for shelter. Poor to fair LWD ratings exist within these drainages, due largely to a lack of functional riparian corridors and recruitment of large conifer and hardwoods species from adjacent upslope areas. Reduced shelter ratings in most stream reaches likely limit the quality of available habitat for juvenile fish survival during critical low summer periods and high flow periods in the winter. Shelter in pools that provides habitat for adult summer steelhead may be lacking due to impacts of major floods in the past.

Habitat Complexity: Percent Primary Pools Complexity and Pool/Riffle/Flatwater Ratios

The frequency of primary pools is poor in most of the tributary streams habitat typed by CDFW in this basin. Most sampled streams have a high percentage of flatwater or run habitat that is less suitable for rearing lifestages of salmonids due to the general lack of depth, complexity and velocity refuge. The lack of pools in this basin likely limits the space available for larger juveniles (e.g. yearling or two year old fish) attempting to maintain territory for feeding and protection from predators. Lack of pool habitats in the all surveyed stream in this basin stems from high sediment production (pool filling) and loss of LWD recruitment from past land use practices and large flood events.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Spawning habitat quality is poor in parts of the basin due to road related and chronic mass wasting sediment delivery to streams. While some recovery of large sediment pulses from the 1955 and 1964 flood events has occurred, road systems, high natural erosion rates, existing slides and grazing to some extent, result in high sediment loads that continue to impact habitat quality.

Other Current Conditions

Unsuitable summer water temperature is limiting steelhead survival in some tributaries in this watershed such as the lower reaches of the Black Butte River and Elk Creek. Tributaries within the Covelo Valley are characterized by low summer baseflow and elevated stream temperatures. Much of the mainstem of the Middle Fork below the Black Butte River has historically had stressful summer temperatures for juvenile salmonids. Altered riparian canopy received a Medium stress rating due to the recovery that has occurred from past land use and natural events such as the 1964 flood. According to USEPA (2003), small (2-3 percent) improvements in canopy in the tributaries and slightly larger (9 percent) in the mainstem reaches are needed to meet natural background levels for this basin.

Water diversion from cannabis producers and associated rural residential water users is likely affecting summer baseflow in some tributaries. Stream reaches located in the Round Valley area typically have very low surface flow or are dry throughout the summer months. Higher gradient tributary streams that historically provided surface flow and rearing habitat for juvenile salmonids are at risk of dewatering due to the increase in residential and agricultural use in this watershed.

Reduced numbers of adult spawners, juveniles and smolts is an imminent stress to the population in this basin. The impact of poaching on the adult summer steelhead population has been a persistent problem due to the remote location, the vulnerability of adult fish in holding pools and the value they have to anglers. Also, predation by introduced Sacramento pikeminnow likely contributes to reduced numbers of juvenile steelhead in the Middle Fork Eel River.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Middle Fork Eel River CAP Results). Recovery strategies will focus on ameliorating threats with High ratings; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Middle Fork Eel River CAP Results.

Roads and Railroads

The greatest road related sediment production in this watershed is from the subbasins that are predominately in private ownership. USEPA (2003) reports that Elk Creek (60 tons/square mile/year) and Williams/Thatcher (170 tons/square mile/year) subbasins produce the highest volume of surface and gully erosion in the basin. Riparian road densities associated with multiple land uses such as forest roads and private ownerships reduce habitat suitability by delivering fine sediment to spawning and rearing reaches.

Fire, Fuel Management and Fire Suppression

In the southern portion of the watershed (Black Butte and Elk Creek) high fuel loads must be managed. Due to past fire suppression actions, the watershed had the potential for large scale, high intensity, stand replacing wildfires that can then result in increased sediment delivery to stream channels (USFS 1995). Since the late 1990s, the USFS has implemented prescribed burning to reduce the potential for high intensity fires. We rated fire and fuel management overall as a Medium threat in this watershed since management of fuel loads has been underway for over two decades in the Mendocino National Forest. We rated the threat of fire and fuel management on the egg lifestage as High due to the potential for sediment delivery to spawning channels in the event of a large fire.

Fishing and Collecting

Poaching of adult summer steelhead has been documented by CDFW since surveys began in 1966. Recent surveys in the summer of 2010 reveal that poaching of summer run adult continues (S. Harris, CDFW, personal communication, 2010). Increased cannabis production noted during the 2010 adult summer steelhead survey has added an additional threat of poaching adult fish from people conducting illegal cannabis activities.

Recreational sport fishing is allowed in the Middle Fork Eel River for adult winter run and summer run steelhead during the winter and spring months. A relatively small number are caught by anglers and reported through the Steelhead Report-Restoration Card Program. Between 2003 and 2005, anglers reported keeping one adult steelhead and 23 were caught and released (CDFG 2007). Some incidental mortality is likely associated with the released adult fish and juvenile steelhead caught by recreational anglers.

Disease, Predation and Competition

The introduction of pike minnow in the 1980s from Lake Pillsbury into the Eel River system continues to result in predation of juveniles and smolts that are produced in the Middle Fork and other areas of the Eel River watershed. Quantitative information is not available regarding the effects of predation on abundance of juvenile and smolt steelhead in the Middle Fork Eel River. Therefore, a Medium threat level was assigned for the potential effect on abundance and competition caused by these non-native species.

Severe Weather Patterns

Large flood events and drought are one of the greatest threat to this highly erosive watershed. Past flood events in 1955 and 1964 have had devastating effects to salmonid habitat by filling pools that are required in the summer for both adults and juvenile steelhead. These floods reduced canopy levels further impacting suitability stream temperatures for rearing juvenile salmonids. Severe drought conditions can reduce migration potential for both winter and summer spawners, habitat availability during the summer and water quality conditions for juvenile fish.

Low or Medium Rated Threats

Agriculture

Cannabis production is a serious and growing threat in this watershed and other watersheds in this area. In the Outlet Creek watershed which has similar cannabis production issues, LeDoux-Bloom and Downie (2008) documented that diversions from large grow operations resulted in dry channels, stranded or dead juvenile salmonids, and a reduced migration potential for juveniles. During 2010 summer steelhead surveys in the Middle Fork Eel River, CDFW biologists noted increased cannabis operations (S. Harris, CDFG, personal communication, 2010), and biologists conducting field surveys in the Black Butte River report similar activities (L. Morgan, USFS, personal communication, 2011). These large (thousands of plants) illegal grow operations require water diversions to supply plants during the summer growing season. These diversions, which are likely to continue over the next decade, can impact baseflow and water quality which limit juvenile rearing habitat during the summer months.

Logging and Wood Harvesting

The USFS and RVIT will continue to conduct timber harvest activities within the watershed. RVIT timber harvest actions will take place in the northwest portion of the Middle Fork Eel River watershed and focus on fuels reduction and sustained yield management objectives (RVIT 2002). The USFS also conducts fuels reduction and timber harvesting while providing for other resource objectives including protection of visual quality, watershed, rare and endemic species, and wildlife (USFS 1995). These timber harvest activities are much improved from past practices that led to unstable slopes and reduced LWD recruitment, therefore, the threat of future timber harvesting in this watershed was rated as Medium.

Limiting Stresses, Lifestages, and Habitats

Both shelter rating and pool habitat are rated as a High stress for summer and winter rearing. Reduced density of spawning adults from poaching was identified as a High stress to summer steelhead. Gravel quality for egg survival and food production for juvenile rearing was rated as a High stress for this population.

Impacts to quantity of baseflow and water quality during the summer from water diversions and introduction of toxins associated with cannabis production were rated as a Medium stress on juvenile rearing habitat. Also shade canopies rate as Poor for many surveyed reaches in the watershed; stream temperatures across much of the basin contribute to reduce juvenile habitat suitability. Restoration actions should address these issues within specific subbasins to increase juvenile steelhead survival and carrying capacity in tributaries.

General Recovery Strategy

Recovery strategies will focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Increase Instream Shelter Ratings and Pool Frequency

Improvement in shelter conditions in most stream reaches in the Middle Fork Eel River watershed is needed. Due largely to past aggradation, and absence of LWD, quality pool habitat is reduced and shelter components are comprised mainly of cobble and boulder. Restoration efforts should focus on protection of large conifers and riparian areas for future recruitment of LWD to improve shelter, and sediment reduction to improve pool frequency and depth. Although pool depth in the upper Middle Fork Eel River is has recovered, the need for improved cover in deep pools needs further investigation.

Reduce Sediment Delivery from Road Systems

Many of the road systems on USFS lands, private timberlands, rural residential and tribal lands need to be upgraded or decommissioned. Road upgrades and stream crossing repair throughout the watershed will reduce fine sediment delivery to streams and reduce the probability of triggering large landslides. The frequency of severe weather patterns is expected to increase, and improved or decommissioned roads will help provide resiliency to large flood events that have had devastating effects to salmonid habitat in the past.

Reduce the Potential for Stand Replacing Fire

Work with the USFS and private landowners on fuels reduction projects in the Mendocino National Forest and private lands. The USFS continues to implement fuels reduction projects that include prescribed fire, mechanical fuels reduction, and thinning to reduce the potential for stand replacing fire. The continued implementation of fuels reduction projects will reduce the potential for large fires that cause accelerated sediment delivery to fish bearing channels.

Reduce Illegal Poaching, and Recreation Fishing

Additional resources must be allocated to protect summer steelhead adults from poaching during the summer and fall months. Reduction or halting recreational fishing for adult steelhead in the Middle Fork basin should be considered to reduce mortality associated with recreational steelhead and trout fishing. Coordination with the RVIT should be conducted to minimize take on tribal lands in order to aid recovery and ensure future use by tribal members.

Address Water Diversion and Toxic Materials

Reduced stream flow from water diversions and groundwater pumping must be minimized to protect and increase juvenile steelhead survival. Federal, state and local government representatives should work with landowners to implement creative solutions that minimize these effects; these solutions should examine conservation methods, water management planning, and water storage and recharge solutions in the Covelo area of the watershed. In addition, improved coordination between NMFS, CDFW, BLM, and USFS and county law enforcement agencies must be implemented to reduce the number of illegal stream diversions within this basin. Additional law enforcement actions to reduce illegal water diversions are expected to reduce the level of toxic materials entering surface waters from cannabis operations.

Funding must also be provided for the cleanup of cannabis production sites to minimize future release of toxic material into stream channels.

Improve Canopy Cover and LWD Volume

Tributaries streams within this watershed would benefit from improved riparian stream shading, LWD recruitment, and increased instream shelter for juvenile fish. General practices to improve riparian condition include increased number of riparian conservation easements (Covelo area), and riparian planting and livestock exclusion fencing where appropriate.

Improve Migration Barriers

Support CDFW staff biologist recommendations regarding migration issues on the Middle Fork Eel River, at the ASA Bean roughs. This is an ongoing issue for summer steelhead adults that are stranded and often perish when this reach dries during summer. Also, passage barriers documented in the Fish Passage Assessment database should be investigated to develop site specific projects to improve or restore passage to spawning and rearing in headwater reaches of this basin.

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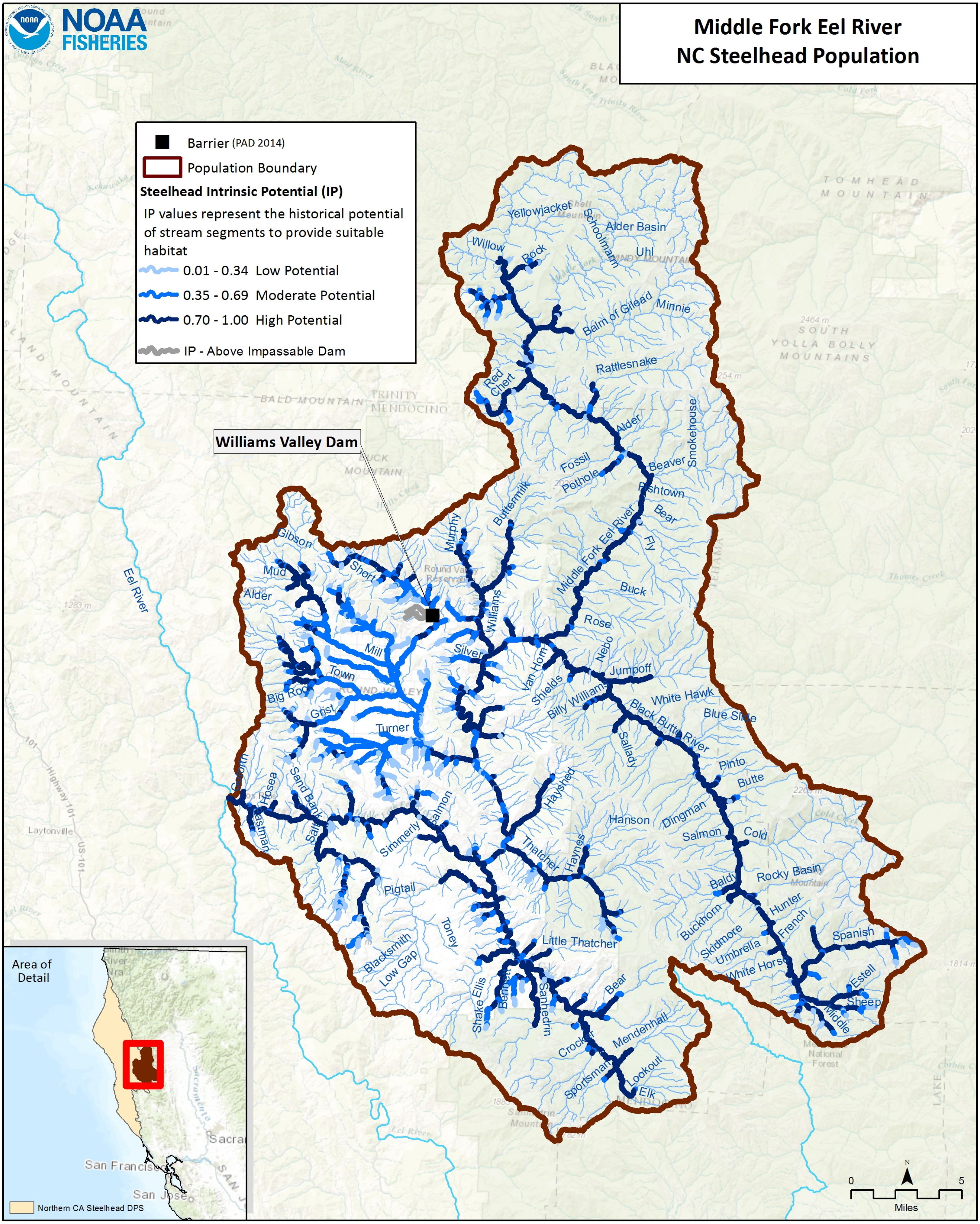
Middle Fork Eel River
NC Steelhead Population
NOAA FISHERIES
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
Williams Valley Dam
Area of Detail
Northern CA Steelhead DPS
Miles

NC Steelhead Middle Fork Eel River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	38% streams/ 13% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	6% sreams/ 15% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	38% streams/ 13% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.5 Diversions	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	44% streams/ 18% IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	38% streams/ 13% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.5 Diversions	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.086% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.368% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	1% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.5 Miles/Square Mile	Very Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	1.2 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-km (>20% staging pool frequency)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Fair
			Water Quality	Mainstem Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
		Size	Viability	Abundance					8-13 adults per IP-km	Fair

NC Steelhead Middle Fork Eel River CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Medium	Medium
2	Channel Modification	Low	Low	Low	Low	High	Low	Low	Medium
3	Disease, Predation and Competition			Medium	Low	High		Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	High	Medium	Medium	Low	High	Medium	High
5	Fishing and Collecting	High		Low		Low		High	High
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Low	Low	Medium
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Low	Medium	Medium	Medium
9	Mining		Low	Low	Low	Low		Low	Low
10	Recreational Areas and Activities			Low	Low			Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low	Low
12	Roads and Railroads	Medium	High	High	Medium	Medium	Medium	Medium	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	Low	Medium	High	High
14	Water Diversion and Impoundments	Low	Low	Low	Low	Low	Medium	Low	Low

Middle Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MFER-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MFER-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
MFER-NCSW-5.1.1.1	Action Step	Passage	Evaluate existing passage information documented by CDFW, or other agencies.	2	5	CDFW, NMFS, Private Landowners	
MFER-NCSW-5.1.1.2	Action Step	Passage	Develop a high priority list of fish passage projects based on CDFW, USFS, and Round Valley Indian Tribe recommendations.	2	10	CDFW, NMFS, Private Landowners	
MFER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MFER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
MFER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a plan or priority list that identifies specific stream reaches that would be suitable for conducting instream habitat complexity projects.	2	1	CDFW, NMFS, Round Valley Indian Tribe, USFS	
MFER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement a large woody debris or other large roughness elements supplementation program to increase stream complexity to improve pool frequency and depth based on a plan or priority list.	3	10	CDFW, NMFS, Round Valley Indian Tribe, USFS	
MFER-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners (private, USFS, and Round Valley Indian tribe) to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	20	CDFW, Private Landowners, USFS	
MFER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MFER-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
MFER-NCSW-7.1.1.1	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	2	20	CDFW, NMFS, Round Valley Indian Tribe, USFS	
MFER-NCSW-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	3	50	CDFW, Mendocino County RCD, NMFS, Private Landowners	
MFER-NCSW-7.1.1.3	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	60	CalFire, County of Mendocino, NMFS	
MFER-NCSW-7.1.1.4	Action Step	Riparian	Prioritize and fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	20	CDFW, Mendocino County RCD, NRCS, Private Landowners	
MFER-NCSW-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MFER-NCSW-10.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
MFER-NCSW-10.1.1.1	Action Step	Viability	Develop and implement a robust fisheries monitoring program for the Eel River watershed including all species of salmonids. Salmonid population trends are critical for achieving recovery criteria and ensuring proper management of in-river and ocean fisheries.	1	5	CDFW, FERC, NMFS, PG&E	
MFER-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**				
MFER-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
MFER-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	3	100	CalFire, County of Mendocino, NMFS	
MFER-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Work with CDF to reduce fuel loads on private lands of high priority within the Middle Fork Eel River.	3	25	CalFire, County of Mendocino, NMFS	
MFER-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Work with USFS to reduce fuel loads in the Mendocino national Forest.	3	20	CalFire, NMFS, USFS	
MFER-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy or existing regulatory mechanisms**				
MFER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
MFER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Investigate the potential to develop a State-Tribal agreement governing Indian Fishing under California Fish and Game Code Sections 16000-16011 with the RVIT to promote recovery of Chinook salmon and steelhead.	1	100	CDFW, CDFW Law Enforcement, NMFS, USFS	
MFER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce incidental take of adult and juvenile steelhead by recreational anglers.	3	20	CDFW, CDFW Law Enforcement, NMFS, USFS	

Middle Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MFER-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead.	1	10	CDFW, CDFW Law Enforcement, NMFS, USFS	
MFER-NCSW-16.1.1.4	Action Step	Fishing/Collecting	Provide additional funding for COMMET, and USFS law enforcement to reduce illegal cannabis activities that result in increased poaching of adult steelhead and protect water quality by preventing the introduction of fertilizer and chemicals into water, and protect water quantity by halting unauthorized stream diversions.	1	10	CDFW Law Enforcement, COMMET, NMFS OLE, USFS	
MFER-NCSW-16.1.1.5	Action Step	Fishing/Collecting	Provide additional funding for CDFW law enforcement to improve protection from poaching activities in the Middle Fork Eel River.	1	20	CDFW Law Enforcement, NMFS OLE, USFS	
MFER-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MFER-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MFER-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners	
MFER-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement road upgrades at high priority sites or systems.	2	10	CDFW, Glenn County, Mendocino County RCD, NMFS, NRCS, Private Landowners	
MFER-NCSW-23.1.1.3	Action Step	Roads/Railroads	Implement road upgrades and/or decommissioning on industrial timberland in the upper Black Butte watershed.	2	10	CDFW, NOAA RC, Private Landowners	
MFER-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade USFS roads that are used for public or administrative use. Decommission roads in the Mendocino National Forest based on USFS prioritization.	2	10	CDFW, NOAA RC, USFS	
MFER-NCSW-23.1.1.5	Action Step	Roads/Railroads	Work with the County of Mendocino DOT to upgrade existing high priority riparian road segments identified by the county.	2	10	CDFW, County of Mendocino, NMFS	
MFER-NCSW-23.1.1.6	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority roads, or those identified in a sediment reduction plan.	2	10	CDFW, NMFS, Private Landowners	
MFER-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MFER-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MFER-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Develop and implement a plan to minimize further diversion of surface flow during the summer period.	3	10	CDFW, Private Landowners	
MFER-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Develop off channel water storage for grazing, cannabis operators, and rural residential users within the watershed to increase summer surface flow across the watershed.	1	20	CDFW, Private Landowners	
MFER-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	3	20	CDFW, Private Landowners	
MFER-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
MFER-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MFER-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	30	CDFW Law Enforcement, COMMET, NMFS OLE, SWRCB	
MFER-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	10	CDFW Law Enforcement, COMMET, NMFS OLE, SWRCB	

North Fork Eel River Population

NC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 6,300 adults
- Current Intrinsic Potential: 315.7 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: N/A

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Quantitative abundance estimates of adult NC steelhead are lacking for the North Fork Eel River. However, available information indicates the steelhead population has declined dramatically over the last century. Keter (1995) estimated the pre-human settlement annual run-size to be approximately 6,930 spawners, with the qualification that numbers may have been higher historically due to better habitat conditions. This estimate was based on interviews and the assumption that the watershed supported 150 spawners per mile. California Department of Fish and Wildlife (CDFW) estimated, based on knowledge from similar streams, that the North Fork Eel River may have supported a population of 5,000 spawners in 1964 (CDFG 1965). Little is known about summer-run steelhead in the population area, although the lack of even anecdotal reports in recent years suggests that the run is either extirpated or extremely depressed (Spence *et al.* 2008).

Split Rock, a large rock deposited in the channel from a landslide located approximately 3.5 miles upstream of the confluence with the mainstem Eel River, likely functions as a migration barrier to adult steelhead at certain flows (USFS and USBLM 1996). No other salmonid species, as well as the non-native Sacramento pikeminnow, are believed to bypass the Split Rock barrier, and are therefore restricted to the lower reach of the North Fork Eel River. There are no known manmade barriers.

History of Land Use

Historic land use of the North Fork Eel River consisted primarily of episodic timber harvest and intense livestock grazing. Euro-American Settlers first arrived in 1854 and by the 1870s approximately 60,000 sheep were grazing within the watershed (USFS and USBLM 1996). Intensive timber harvest on private lands occurred in the 1950s and 1960s, predominantly by tractor-logging which commonly occurred on slopes greater than 70-percent (USFS and USBLM 1996). Timber harvest on public lands peaked on USFS lands during the 1970s, with approximately 1,200 acres clear cut during that time (USFS and USBLM 1996).

Stream habitat in the North Fork Eel River has been significantly modified by both human and natural causes. The flood of 1964 severely modified the stream channel and riparian vegetation. A local resident indicated that the "channel was so heavily filled with soil and debris that the river bed was level and vehicles could drive for miles up the river bed" (Keter 1995). USFS (2002) noted that approximately 90 percent of the mainstem North Fork Eel River riparian canopy was removed by the 1964 flood. Large landslides continued to fill in the stream bed years after the flood, severely aggrading the channel (USFS 2002).

Potter Valley Project releases contribute to flows for the entire extent of the mainstem Eel River (VTN 1982; SEC 1998) and thereby influence rearing and migration conditions for juvenile steelhead in the mainstem and estuary, and staging, holding, and upstream migration conditions for adult summer steelhead. Project releases generally approximate unimpaired flows during the summer and fall (NMFS 2002), but may deviate from the natural hydrograph during the winter and early spring as runoff is impounded to fill the Lake Pillsbury reservoir. Sacramento pikeminnow were introduced to Lake Pillsbury in 1980 (CDFG 1997), and have since colonized all accessible reaches of the Eel River watershed. This predator thrives in the warmer waters created within the reservoir, as well as the shallow mainstem reaches caused by high sediment loads, and degraded riparian forests. In the Eel River estuary, construction of dikes and levees resulted in a mass conversion of tidelands to pasture.

Current Resources and Land Management

Approximately 50 percent of the North Fork Eel River basin is federally managed (41 percent Six Rivers National Forest, 9 percent Bureau of Land Management). Ranches, rural residences, private timberlands, and the Round Valley Indian Reservation make up the remaining 50 percent. Federal lands are currently managed under the Northwest Forest Plan, with 35 percent of Federal lands "withdrawn" or designated wilderness; 21 percent classified as late successional reserve, and 44 percent classified as matrix (*i.e.*, resource extraction permitted). Grazing is currently managed by the Six Rivers National Forest and the Bureau of Land Management. Current management practices of these land managers include monitoring rangeland conditions and resting allotments to allow recovery of vegetation. There are several active watershed groups in the area: the Eel River Watershed Improvement Group, Friends of the Eel River, and the Eel River Recovery Project.

The following are pertinent reports or plans for the North Fork Eel River:

- North Fork Eel River Watershed Analysis (USFS and BLM 1996);
- North Fork Eel River Total Maximum Daily Loads for Sediment and Temperature (USEPA 2002); and
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for steelhead (see North Fork Eel River CAP results): estuary quality and extent, large woody debris (LWD) frequency, pool/riffle/flatwater ratio, baseflow conditions, smolt passage flows, tree diameter, canopy cover, D50, stream-side road density, shelter rating, and temperature. Recovery strategies and actions will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions with the population area.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The North Fork of the Eel River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Viability: Density, Abundance, and Spatial Structure

Although steelhead juveniles are well distributed throughout the population area (Becker and Reining 2009), the abundance of North Fork Eel River steelhead is likely very limited compared to historical levels, and the degraded habitat in the population (SEC 2012) is likely incapable of producing the number of spawners needed for the population to be at Low risk of extinction (6,400 adults). In addition, the severely limited numbers, or absence, of adult summer steelhead reflect a greatly diminished level of diversity for the population. Reduced density, abundance, and diversity conditions have an overall rating of Fair for winter-run and summer-run adult, smolt, and summer rearing juvenile steelhead.

Habitat Complexity: Large Wood and Shelter

Surveys conducted by CDFW indicate that shelter ratings are Very Poor throughout the population area, with only 39 percent of the IP habitat having met desired levels for shelter and LWD (SEC 2012). These habitat complexity features have primarily been impaired due to a deficit of streamside vegetation and a large supply of sediment. Currently, shelter primarily exists in the form of bedrock pools and undercut banks, as large wood retention is difficult in the steep and flashy channel networks typical of the population area. This condition has a rating of Poor for summer rearing and winter rearing juveniles, and summer-run adults.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Available data indicate that there are not enough suitable juvenile rearing pools or adult holding pools in the population area (SEC 2012). Increased sediment yield from roads, grazing, and historic timber harvest activities, coupled with the extreme flood events of 1955 and 1964, has resulted in aggraded channels and shallow pools. Those pools available for juvenile use provide insufficient number and diversity of cover elements such as undercut banks, woody debris, and root masses (SEC 2012). This condition has an overall Poor rating for winter-run and summer-run adults, and summer rearing juveniles.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediment conditions have a rating of Fair for winter-run adults and eggs. The North Fork Eel River is listed as sediment-impaired under section 303(d) of the Clean Water Act (USEPA 2002). The Eel River is one of the most erosive watersheds in the United States because of highly active tectonics, highly erodible soils, and high precipitation (Brown and Ritter 1971). Fine sediment loads are at unacceptable levels in much of the North Fork Eel River (USEPA 2002), leading to highly embedded gravels and a small median particle size (SEC 2012). USEPA (2002) determined that approximately 30 percent of total sediment was related to human activity, which is lower than most watersheds studied in northern California. Excessive fine sediment can result in sub-surface flows, disconnected or discontinuous stream channels, poor spawning habitat for adults, suffocation of eggs, reduced velocity refugia for winter rearing juveniles, and reduced productivity of food for winter and summer-rearing juveniles. Although gravel quality is currently poor, improved management on Federal lands combined with natural passive recovery from the 1964 flood should produce more suitable gravels in the future.

Hydrology: Baseflow and Passage Flows

Many of the smaller tributaries in the North Fork Eel River population area dry up completely during the summer, and the mainstem North Fork Eel River channel becomes intermittently dry. The intermittent mainstem North Fork Eel River can prevent outmigration of summer-rearing steelhead, effectively stranding them in potentially lethal waters. Several spring-fed tributaries in the population area maintain perennial flow or intermittent pools that serve as thermal refugia. Change from historic vegetative conditions in the North Fork Eel River watershed has resulted in increased density of brush and understory species and has likely resulted in ground water depletion (and, therefore, reduced summer baseflow) through interception and evapotranspiration (Keter 1995).

Reduced summer flows in the mainstem Eel River, an important migratory corridor and rearing area for North Fork Eel River steelhead, can be partly attributed to increased evapotranspiration rates resulting from replacement of old-growth forests with younger forests (Perry 2007). Reduced flows in the mainstem Eel River also likely reflect increased demand for water for marijuana cultivation (S. Bauer, CDFW, personal communication, January 17, 2013). Potter Valley Project releases generally approximate unimpaired flows during the summer and fall (NMFS 2002), but may deviate from the natural hydrograph during the winter and early spring as runoff is impounded to fill the Lake Pillsbury reservoir. Hydrology conditions have a rating of Poor for summer rearing juveniles and summer-run adults.

Water Quality: Temperature

The North Fork Eel River is listed as temperature-impaired under section 303(d) of the Clean Water Act (USEPA 2002). High summer water temperatures are a significant stress to the population, especially in the wide, exposed lower reaches of tributaries and in the mainstem river (CDFG 1997). The naturally hot climate, combined with low summer baseflows and a lack of riparian vegetation results in near-lethal or lethal water temperature in many parts of the population area. A thermal infrared and color videography snapshot of stream temperatures on the entire stretch of the mainstem North Fork Eel during July 2001 showed the mainstem North Fork Eel to be over 20°C (considered inadequate for steelhead) for its entire 35.3 mile extent, with many sections over 24°C (near lethal for steelhead) (USEPA 2002).

Summer juvenile distribution is likely limited to those areas of the watershed with cold spring upwelling or cold tributary inflow. It is likely that a proportion of juveniles leave the North Fork Eel River, as observed in the adjacent Middle Fork Eel River (Smith and Elwell 1961), prior to onset of summer baseflow to take advantage of more suitable conditions in the coastally influenced climate of the lower mainstem Eel River and Eel River estuary. This condition has a Poor rating for summer rearing juveniles and summer-run adults.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of Eel River salmonid populations. The Eel River estuary is currently severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Riparian Vegetation: Composition, Cover & Tree Diameter

Due to fire suppression and changes in land use following settlement, former oak woodlands have been replaced by Douglas-fir forests in the North Fork Eel River population area (Keter 1995). This change from historic conditions has resulted in increased density of brush and understory species and has likely resulted in ground water depletion (and, therefore, reduced summer baseflow) through interception and evapotranspiration (Keter 1995). These conditions have an overall Poor rating.

Sediment Transport: Road Density

High road densities within the population area are primarily associated with rural residences and past timber harvest. Of particular concern is the high density (2.26 miles/square mile) of roads within 100-meters of stream channels (SEC 2012). Although significant efforts to decommission and upgrade roads have occurred and continue to occur on Federal lands, road densities remain high on private lands. Sediment Transport conditions from road density has a rating of Poor for watershed processes.

Very Good or Good Current Conditions

Hydrology: Impervious Surfaces and Passage/Migration: Mouth or Confluence and Physical Barriers

Due to the lack of residential, urban, and industrial land use in the watershed, impervious surfaces are rare and therefore have an overall rating of Very Good. Few physical barriers exist in the watershed and steelhead have access to almost all of their historical habitat; therefore, physical barriers have an overall rating of Very Good. The majority of tributaries likely maintain connectivity with the mainstem throughout the wet season; therefore, passage conditions have a Good rating for winter and summer adults.

Threats

The following discussion focuses on those threats that are rated as High or Very High. Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in North Fork Eel River CAP results.

Roads and Railroads

Some lower subbasins have been subdivided and contain a high density of roads used year-round (CDFG 1997). These roads contribute fine sediment to streams and disrupt normal runoff patterns. Road decommissioning has occurred and continues to occur on federally managed lands in the upper half of the population area. This stress is rated High for watershed processes.

Channel Modification

Channel modification was rated as a High stress for summer rearing juvenile and smolt steelhead. Channel modification is not a current concern within the North Fork Eel River population area, but the Eel River estuary and mainstem have been significantly channelized by dikes and levees and subsequent filling for ranching or livestock purposes. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Fire, Fuel Management, and Fire Suppression

USFS and USBLM (1996) determined the North Fork Eel River watershed was at risk for high to extreme fire behavior. Ladder fuels, which provide the opportunity for ground fires to move upward, are common and create the potential for crown fires that can kill valuable riparian trees (USFS and USBLM 1996). Fire was rated as a High risk to summer rearing juveniles.

Low or Medium Rated Threats

Disease, Predation and Competition

Disease, predation and competition was rated as a Medium threat to summer rearing juveniles and smolt steelhead primarily due to the presence of the predatory non-native Sacramento pikeminnow. Several other non-native predators are known to exist, but the pikeminnow has become ubiquitous throughout the Eel River and its tributaries, and is a known predator of salmonids. Removal of pikeminnow has, on the whole, been unsuccessful in the Eel River. Pikeminnow thrive in waters warmer than those suitable for salmonids (Bettelheim 2001), so reducing water temperature to match salmonid habitat requirements would make the habitat less suitable to pikeminnow and may help control the species. The lifestages present in the North Fork (lower five miles downstream of Split Rock) and Mainstem Eel rivers during late spring and summer months are most vulnerable, as this is when conditions are most favorable to pikeminnow. Split Rock is believed to prevent upstream migration of pikeminnow and therefore areas upstream of Split Rock are not subject to the negative implications of predation and competition caused by pikeminnow.

Livestock Farming and Ranching

Grazing pressure on Federal lands is light compared to historic levels and is being managed to minimize effects to steelhead habitat (USFS and USBLM 1996). However, grazing practices on private lands is unknown and could be having localized effects to steelhead habitat. Therefore, livestock are believed to be a Medium threat to all lifestages of steelhead.

Severe Weather Patterns

The low summer flows and hot climate of the North Fork Eel River make the population area more sensitive to drought conditions. Rearing steelhead would likely not survive and would be forced to rear elsewhere if weather patterns were to cause further degradation of already degraded habitats.

Water Diversion and Impoundments

Although there are few diversions in the population area, any diversion or groundwater pumping in the summer exacerbates already stressful rearing conditions for steelhead.

Limiting Stresses, Lifestages, and Habitats

Juvenile steelhead are limited by poor rearing conditions during the summer months. Poor rearing conditions are primarily the result of intrinsically high water temperatures exacerbated by a lack of riparian cover, and low baseflows caused by channel aggradation and an altered riparian vegetation community. Summer juveniles and smolts are also at risk due to a lack of well-sheltered pool habitat, predation by Sacramento pikeminnow, and degraded and reduced nursery habitat in the estuary.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the North Fork Eel River steelhead population is discussed below with more detailed and site-specific recovery actions provided in North Fork Eel River CAP results, which provides the Implementation Schedule for this population.

Focus Initial Efforts on Restoring Key Tributaries

Several tributaries to the North Fork Eel River have been identified as good steelhead habitat and capable of supporting high densities of steelhead (USFS and USBLM 1996). Efforts should be focused on these key tributaries in the early phases of recovery plan implementation, to ensure that conditions are improved in areas that are occupied and functional. These tributaries include

West Fork North Fork Eel River, Bluff/Kettenpom creeks, Red Mountain Creek, Hull's Creek, and Asbill Creek (USFS and USBLM 1996).

Reduce Summer Water Temperature

High water temperatures limit growth and survival of juvenile steelhead. In streams with less than 80 percent shade canopy, riparian vegetation should be managed to increase shade. Livestock exclusion fencing should be used to protect riparian vegetation where feasible. Increasing instream flows should help reduce water temperatures.

Improve Summer Flows

Instream flows in the North Fork Eel River should be increased during the summer months by providing incentives to reduce diversions during the summer, establishing a forbearance program using water storage tanks to decrease diversions during periods of low flow, and creating water budgets to avoid over allocating water diversions. In addition, investigate whether encroachment of Douglas fir on former oak woodlands has affected groundwater recharge or streamflow.

Increase Habitat Complexity

Pools in the North Fork Eel River and mainstem Eel River are too simplified and shallow to support steelhead growth and survival. Large wood, boulders, or other instream structure should be added in proximity to cool water refugia in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be re-created in the low-gradient areas of the population area, as well as the lower mainstem Eel River.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor steelhead habitat conditions. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance which minimizes effects on salmonid habitat should be developed for building and maintenance of private roads.

Reduce Abundance of Sacramento Pikeminnow

Explore how best to reduce the abundance of the Sacramento pikeminnow population. Provide increased refugia habitat for salmonids through the creation of cool and complex habitats, and make habitat less suitable for pikeminnow by managing to reduce water temperature.

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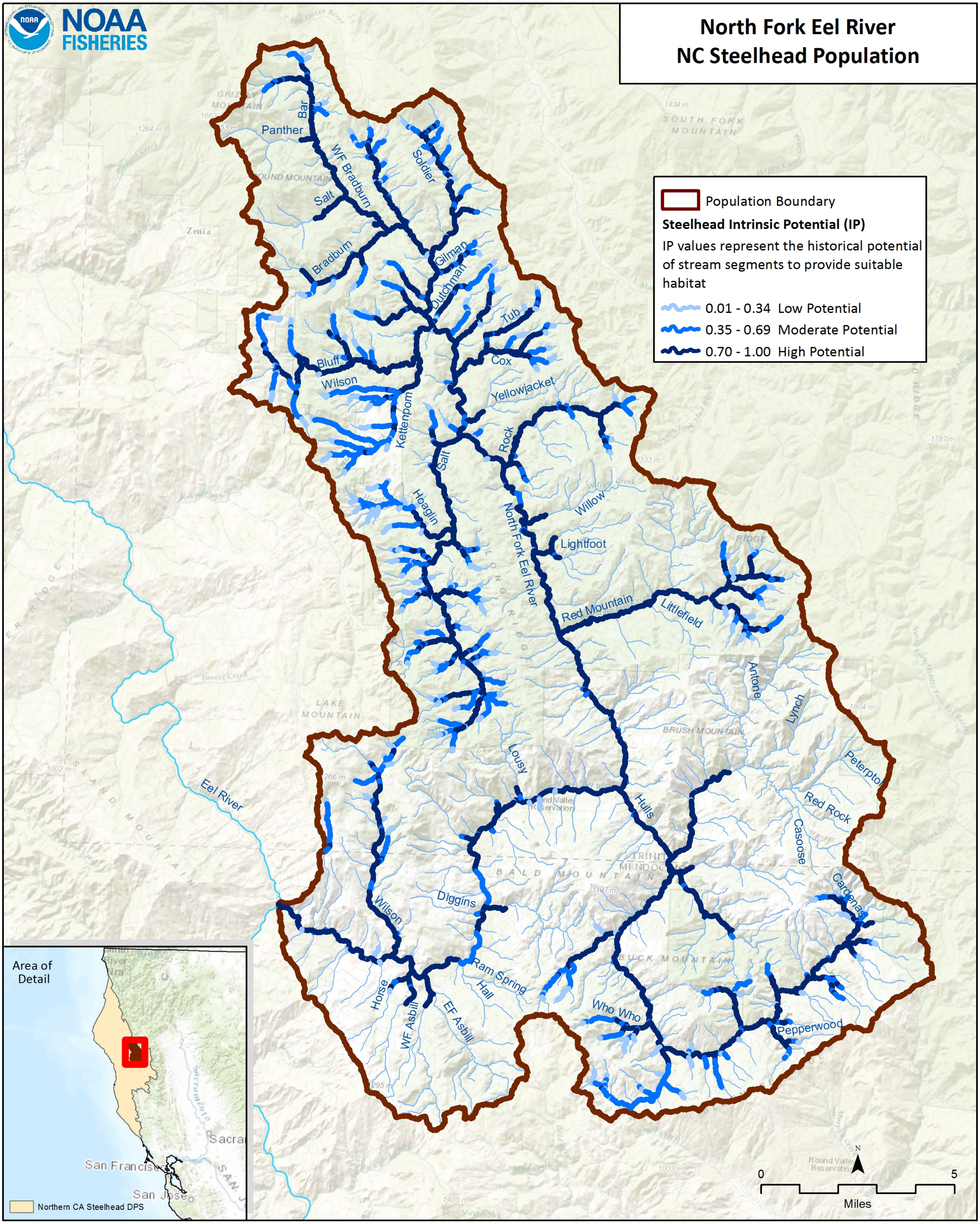

NOAA FISHERIES
North Fork Eel River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Bar
Panther
WF Bradburn
Soldier
Salt
Bradburn
Gilman
Dutchman
Tub
Bluff
Wilson
Cox
Yellowjacket
Kettenpom
Rock
Salt
Hoaglin
Willow
Lightfoot
North Fork Eel River
Red Mountain
Littlefield
Antone
Lynch
Lousy
Eel River
Peterpot
Hulls
Red Rock
Casoose
Cardenas
Wilson
Diggins
Ram Spring
Hall
Horse
WF Asbill
EF Asbill
Who Who
Pepperwood
0
5
Miles
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS

NC Steelhead North Fork Eel River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	21% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	.22-.35	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	99.1 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	18.61% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		low risk spawner density per Spence et al (2012)	Good
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 23	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	72% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	16% of streams/ IP-Km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	21% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	.22-.35	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 83	Poor

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	Fair
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.05 Diversions/10 IP km	Good
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	99.1 of IP-km	Very Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	26% of streams/ IP-Km (>70% average stream canopy)	Poor
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	18.61% Class 5 & 6 across IP-km	Poor
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Poor
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	72% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair

			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	21% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	.22-.35	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	99.1 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	18.61% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	72% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.05 Diversions/10 IP km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	<50% IP-Km (>6 and <14 C)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.04% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	7.68% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.96 Miles/Square Mile	Fair
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.26 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	<50% of streams/ IP-Km (>20% staging pool frequency)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 83	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
		Size	Viability	Abundance					Few to none believed to occur in NF Eel	Poor

NC Steelhead North Fork Eel River CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Low	Low	Medium	Low	Medium	Low	Medium	Medium
2	Channel Modification	Low	Low	Medium	Low	High	Low	Medium	Medium
3	Disease, Predation and Competition	Low		Medium	Low	Medium	Low	Medium	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	High	Low	Low	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Low		Low		Medium	Medium
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Medium	Medium	Medium	Medium	Medium	Low	Medium	Medium
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Medium	Low	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Medium	Medium
11	Residential and Commercial Development	Low	Low	Medium	Low	Medium	Low	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	High	Medium	High
13	Severe Weather Patterns	Medium	Low	Medium	Low	Low	Low	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium	Medium

North Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NFER-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
NFER-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	3	2	CDFW	
NFER-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Guided by assessment, re-connect the floodplain by constructing off channel ponds, alcoves, backwater habitat, and old stream oxbows.	3	10	CDFW	
NFER-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
NFER-NCSW-3.1.1.1	Action Step	Hydrology	Assess whether Douglas fir encroachment on former oak woodlands has affected groundwater recharge or streamflow.	2	1	USFS	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-3.1.1.2	Action Step	Hydrology	If Douglas fir encroachment has reduced groundwater recharge or streamflow, re-establish a more natural vegetative community.	2	25	USFS	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-3.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
NFER-NCSW-3.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
NFER-NCSW-3.2.1.1	Action Step	Hydrology	Ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB	
NFER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
NFER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	1	USFS	Tributaries, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Place instream structures, guided by assessment	2	10	USFS	Tributaries, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
NFER-NCSW-7.1.1.1	Action Step	Riparian	Plant native riparian species in denuded areas.	2	20		Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-7.1.1.2	Action Step	Riparian	Remove non-native species that inhibit establishment of native riparian vegetation.	2	10		Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Final costs will vary depending on methods implemented and extent of rehabilitation.
NFER-NCSW-7.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
NFER-NCSW-7.2.1	Recovery Action	Riparian	Improve riparian conditions				
NFER-NCSW-7.2.1.1	Action Step	Riparian	Reduce detrimental environmental impacts of conversion of TPZ land to other uses.	2	5	NMFS, Calfire, BOF	
NFER-NCSW-7.2.1.2	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	5	NMFS, Calfire, BOF	
NFER-NCSW-7.2.1.3	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	5	Calfire, BOF	
NFER-NCSW-7.2.1.4	Action Step	Riparian	Work to ensure effects of activities on converted areas are minimized.	2	5	NMFS, Calfire, BOF	
NFER-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

North Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NFER-NCSW-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
NFER-NCSW-14.1.1.1	Action Step	Disease/ Predation/ Competition	Assess feasibility and benefits of various methods to eradicate or suppress Sacramento pikeminnow, including genetic technology methods (e.g., deleterious genes).	3	5	CDFW	
NFER-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Take measures to eradicate or suppress fish species using genetic technology or other methods identified as feasible.	3	25	CDFW	
NFER-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure				
NFER-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Reestablish natural fire regime.	2	5	USFS	
NFER-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Identify areas prone to high severity fire and develop a strategic plan to reestablish a natural fire regime that benefits steelhead habitat.	2	5	USFS	
NFER-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Carry out fuel reduction projects such as thinning and prescribed burning, guided by the strategic plan.	2	100	USFS	
NFER-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
NFER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
NFER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	1	5	CDFW, NMFS	
NFER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Title 14, Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers to restrict fishing during low flow periods.	1	5	CDFW, NMFS	
NFER-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
NFER-NCSW-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from areas	3	1	NRCS, RCD	
NFER-NCSW-18.1.1.2	Action Step	Livestock	Install fence, guided by plan	3	10	NRCS, RCD	
NFER-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
NFER-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	3	1	CalFire, CDFW, Private Landowners, Timber	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	10	CalFire, CDFW, Private Landowners, Timber	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-23.1.1.3	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	25	CalFire, CDFW, Private Landowners, Timber	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	25	CalFire, CDFW, Private Landowners, Timber	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River.
NFER-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NFER-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				

North Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NFER-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Increase instream flows by establishing a forbearance program, by using water storage tanks to decrease diversion during periods of low flow.	3	1	CDFW, NMFS, RWQCB, SWRCB	
NFER-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flows.	3	25	CDFW, NMFS, RWQCB, SWRCB	

Upper Mainstem Eel River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 6,400 adults
- Current Intrinsic Potential: 317.5 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: N/A

Upper Middle Mainstem Eel River Population

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: N/A

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The watershed area that makes up the Upper Mainstem Eel River steelhead population begins at the confluence of Soda Creek (1.3 miles below Scott Dam) and extends upstream above Scott Dam (Lake Pillsbury), encompassing the Lake Pillsbury sub-basin and associated tributaries. Since 1922, adult steelhead have been counted at the Van Arsdale Fish Station (VAFS). VAFS is located 12 miles downstream of the Scott Dam, and approximately 10.5 miles downstream of Soda Creek. Information reported by Steiner Environmental Consulting (SEC 1998) indicates relatively high numbers of adult steelhead were counted at VAFS in the 1930s, often exceeding 3,000 individuals. A decline in steelhead numbers was observed in the 1950s with numbers of steelhead passing VAFS decreasing to less than 1,000 adults. Recent counts range from 166 (2010/11) to 935 fish (2012/13) adult steelhead, with an average around 250 to 300 adults (S. Harris, CDFW, personal communication, 2013). Currently, only 1.3 miles of habitat is accessible for this steelhead population due to the construction of Scott Dam

Limited data is available for the summer-run steelhead population in the Upper Eel River. Data collection of summer-run steelhead and passage opportunities above VAFS has been severely restricted due to operations at the facility. VAFS typically closes when the adult winter-run steelhead season is over and outmigrant trapping begins. However, the majority of summer-run steelhead were most likely lost following the construction of Scott Dam, many years prior to the 1987 passage improvements that occurred to VAFS. Jones (2000) reported a snorkel survey observation of one adult steelhead between Scott Dam and VAFS in 1985, and 19 other adults were reported by CDFW staff near the VAFS screen during that summer.

Juvenile steelhead distribution surveys have been conducted by CDFW in tributary streams that flow into Lake Pillsbury and have documented the presence of *O.mykiss* and viable steelhead habitat in these tributary streams. The degree at which this landlocked *O.mykiss* population expresses an adfluvial life history is currently unknown. Almost 100-years has passed since anadromous steelhead were blocked to habitat above Scott Dam. Two major tributaries encompass the majority of the watershed that drains into Lake Pillsbury: mainstem Eel River and the Rice Fork. Minor tributaries include Salmon Creek, Smokehouse Creek and a few other smaller tributaries. Habitat typing and associated stock assessment surveys conducted in 2009 documented the presence of juvenile *O. mykiss* in most tributaries, and the upper reaches of the Eel River.

Virtually all steelhead habitat within the Upper Mainstem Eel River steelhead population exists above Scott Dam. Tributaries to the Eel River such as Rattlesnake, Trout, and Corbin creeks are reported to have good salmonid habitat conditions (Becker and Reining 2009). The Rice Fork also has tributaries that provide spawning and rearing habitat, but are lower gradient and warmer which has most likely caused an increase in Sacramento pikeminnow (*Ptychocheilus grandis*) in most tributaries and mainstem reaches of the Rice Fork. Past stream surveys by CDFW report medium to low quality habitat in Rice Fork, and Bear, Rock, and Willow creeks.

History of Land Use

Land use activities in the Upper Mainstem Eel River include timber harvest, recreation, limited livestock operations, and rural residential development. The Potter Valley Project's Cape Horn Dam and egg collecting station was completed by Snow Mountain Power and Water Company in 1908 (SEC 1998). This power and water company then completed Scott Dam in 1922 and sold the project including the Cape Horn Dam/Egg Station and diversion facility to Pacific Gas and

Electric Company (PG&E) in 1930. These dams represent the most significant Upper Mainstem Eel River salmonid habitat alterations and resulted in the loss of most of the historic habitat for Upper Eel River Chinook salmon and steelhead trout, likely including the summer-run steelhead population. Built without a fish ladder, Scott Dam blocks between 58.4 and 120 plus miles of anadromous steelhead habitat (Venture Tech Network Oregon Inc. 1982; Spence *et al.* 2012). Approximately, 12 miles of habitat currently exists between Scott and Cape Horn dams, which is accessible to salmonids via the Van Arsdale Fish Station. SEC (1998) reports that the Cape Horn Fish ladder has undergone many modifications, including 1915, 1962, and 1987 when major modifications were required as part of the Federal Energy Commission Article 40 opinion 187. However, some trap inefficiencies may still remain. For example, few or no post-spawn steelhead (kelts) are reported during the trapping season.

With an approximate 75,000 acre-feet (AF) capacity, Lake Pillsbury is situated upon most of the high IP reaches present in the population area. From 1992 to 2004, up to approximately 160,000 AF of Eel River water were annually diverted into the East Fork of the Russian River for hydropower production agricultural and municipal uses. The required minimum streamflow released at Cape Horn Dam was 2 cfs year-round up until 1979, when major changes in releases were implemented to mimic the pattern and timing of the natural hydrograph. These new releases were initially implemented as study releases, but have been implemented continuously ever since with modifications over the years based on the results of various fisheries studies conducted by PG&E. In 2004, as a result of further modifications to flow regimes initiated in 1979, the Federal Energy Regulatory Commission issued an order requiring PG&E to implement an instream flow regime consistent with the Reasonable and Prudent Alternative in the NMFS 2002 Biological Opinion. The new flow requirement increased the minimum Cape Horn Dam release flows and incorporated within-year and between-year flow variability. These flows provide quasi-natural flows for fall and winter migrations, spring emigrations, and in some years will provide improved summer rearing habitat in the mainstem Eel River below the VAFS (NMFS 2002). Still, between 2007-2012 the Potter Valley Project annually diverted approximately 22-percent of the estimated unimpaired flow at the point of diversion (*i.e.,* Cape Horn Dam), with an mean annual diversion of 77,000 acre-feet (P. Kubicek, PG&E, personal communication 2013).

The 1964 flood caused significant sedimentation within the Eel River and its tributaries, by filling in many pools, destroying riparian vegetation, and widening channels. Timber harvest activities were widespread and resulted in sediment transport into stream channels. The preponderance of unstable landforms, high road densities, and past timber harvest has contributed to the poor habitat quality evident throughout the Eel River watershed.

In 1980, piscivorous Sacramento pikeminnow were introduced into Lake Pillsbury (CDFG 1997), and now occupy the entirety of the Eel River basin's accessible habitat. This predator has thrived in the Eel River and now occupies most main stem and lower tributaries areas of the Eel River. It is thought that the highest densities of pikeminnow exist within Lake Pillsbury and within the Potter Valley Project. Recent surveys by the CDFW reports, Sacramento pikeminnow are present in large numbers in Lake Pillsbury, and many of the larger tributaries that drain into the lake, primarily the mainstem Eel River and Rice Fork (S. Harris, CDFW, personal communication, 2013).

Current Resources and Land Management

The Upper Eel River watershed above Scott Dam encompasses an area of 289 square miles, roughly 7.3 percent of the Eel River's total 3,971 square mile watershed. Eighty-nine percent of the land is owned and managed by the United States Forest Service (USFS) Mendocino National Forest, and the remaining is private with a very small (<100 acres) area owned by the State. The USFS manages the majority of the watershed in the Upper Eel River under the Land and Resource Management Plan (LRMP) for the Mendocino National Forest. Private lands are characterized by large ranches, and smaller private ownerships that are developed around Lake Pillsbury.

Salmonid Viability and Habitat Conditions

The following habitat indicators were rated Poor through the CAP process: Passage and migration for the adult and smolt life stages for summer and winter run populations. Reduced density for spawners was rated poor due to the loss of habitat accessibility at Scott Dam. Loss in spatial structure for juvenile distribution was also rated poor due to the passage impairment that the dam has caused. Habitat conditions that rated poor included LWD frequency, shelter rating, primary pool frequency, and pool riffle ratio for adults and juvenile life stages. Gravel embeddedness was rated poor for the egg life stage and food production for juvenile fish. The only indicator for watershed process that was rated as poor through the CAP analysis was road density within riparian areas. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes. Indicators that were rated as Fair through the CAP process, but are considered important within specific areas of the watershed include baseflow, canopy cover, and toxicity of tributary streams during the juvenile rearing period.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis; the Upper Eel River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Passage/Migration: Mouth or Confluence and Physical Barriers

Scott Dam currently blocks access to 99 percent of the potential habitat available to this steelhead population (Spence *et al.* 2012). Steelhead have not had access to this habitat since 1922. Lake Pillsbury currently maintains habitat for non-native species of Sacramento pikeminnow and largemouth bass (*Micropterus salmoides*). The reservoir provides habitat for these non-native species to survive and maintain high densities in the larger streams that drain into Lake Pillsbury. In addition, the hydrology, and sediment transport to the mainstem Eel River is disrupted by this facility. The genetic diversity of *O.mykiss* that remained above the lake has likely been altered by hatchery trout planting that has occurred since the 1930s. The extent of the impact to the native population in the Upper Eel River is unknown at this time.

Habitat Complexity: Large Wood and Shelter

Suitable shelter ratings are required for juvenile salmonids as well as adult spawners for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. Stream surveys conducted in the 1990s by CDFG indicate shelter ratings throughout the Upper Eel River, Rice Fork and its tributaries have Poor to Fair quality habitat.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The frequency of primary pools is poor in main reaches of the Eel River and the Rice Fork due to sediment aggradation caused by the presence of Lake Pillsbury. USEPA (2004) summarizes the sediment conditions as adverse for salmonids due to the combined effects of the 1964 flood and past land use practices. Poor conditions for salmonid survival include high coarse and fine sediment loads and pool filling in lower gradient response reaches that normally provide the most productive spawning and rearing habitat.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Spawning habitat quality is poor in most tributaries due to road related and chronic mass wasting from slides that occur in the basin. There are over 175 miles of trails (including 100 miles of off-highway vehicle trails), 760 miles of roads, and 3900 road/stream crossings in the Lake Pillsbury Hydrologic Unit (USEPA 2004). While some recovery from large sediment pulses from the 1955 and 1964 flood events has occurred, road systems, high natural erosion rates, and existing slides result in high sediment loads to tributaries draining into Lake Pillsbury.

Other Current Conditions

Summer water temperature may be limiting rainbow/steelhead survival in some tributaries of the Lake Pillsbury sub-basin, such as the lower reaches of the Eel River, and Rice Fork. However, some of the tributaries to the Rice Fork are reported to have moderately suitable rearing conditions for salmonids, and it is unknown how *O. mykiss* currently utilize the coldwater zone of Lake Pillsbury. Altered riparian canopy received a Fair rating due to the recovery that has occurred from past land use and natural events such as the 1964 flood.

Water diversion from large illegal cannabis cultivators and associated rural residential water user is likely further reducing summer base flow in some tributaries where flows are naturally low in the summer due to the warmer physical setting of the interior Middle Fork Eel River watershed. Additional stress of surface flow diversions and groundwater reductions from increased cannabis production and rural residential use is likely a moderate contributor in limiting *O. mykiss* production in this watershed unless properly regulated in the future.

In addition, it is likely that years of hatchery rainbow trout plantings in Lake Pillsbury and Rice Fork have led to a reduction in genetic integrity of native origin *O. mykiss* above Scott Dam. Impacts from Sacramento pikeminnow competition and predation are an ongoing problem in the Eel River up to the Bloody Rock area and in the Rice Fork (S. Harris, CDFW, personal communication, 2012).

Threats

The following discussion focuses on those threats that rate as High or Very High (see Upper Eel River CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Upper Eel River CAP Results.

Water Diversion and Impoundments

Water diversions and impoundments remain a threat to adult and juvenile steelhead primarily due to the existence of Scott Dam and associated operations of the Potter Valley Project. Efforts continue to optimize conditions downstream of Scott Dam with the use of blockwater and manipulations of water temperatures to provide timely habitat conditions. Other components of the Potter Valley Project need further investigation. For example, better understanding of Lake Pillsbury water quality dynamics, particularly temperature and dissolved oxygen, may offer better operational scenarios for rearing juvenile steelhead in the future. This threat to recovery is expected to continue in the future, however, re-examination of the Potter Valley Project will officially start in 2017 as part of the FERC relicensing process.

Other potential water diversion and impoundment threats to this steelhead population include cannabis cultivation and rural residential water diversions associated with private land holdings in and around the Potter Valley Project. Specifically, cannabis activities in the Salmon Creek and Rice Fork watersheds are believed to reduce summer surface flows that provide rearing habitat for juvenile salmonids. Ongoing and illegal cannabis operations in the Mendocino National Forest also negatively impact surface flow to the Eel River and its tributaries in the summer months.

Roads and Railroads

Roads and trails on the USFS and some private lands continue to cause increased sediment production in this watershed. Road related debris slides, road related gullying, surface erosion, and sediment from stream crossing are the primary sources of the anthropogenic sediment delivery (USEPA 2004). These sediment sources continue to reduce salmonid habitat suitability by delivering fine sediment to spawning and rearing reaches.

Other Threats

Other threats that continue to cause sources of stress to salmonid habitat include predation and competition, fire and fuel suppression, severe weather patterns, and water diversions associated with rural residential development and cannabis production.

The introduction of pikeminnow in the 1980s from Lake Pillsbury into the Eel River system continues to result in predation of juveniles salmonids that are produced in the Upper Eel River watershed. Quantitative information is not available regarding the effects of predation and competition on abundance of juvenile rainbow trout/steelhead in the Eel River and tributaries draining into Lake Pillsbury. A high threat level was assigned for the effects of loss in abundance and competition that these non-native species present to juvenile life stages of rainbow/ steelhead that persist in the basin.

Fire and fuel management associated with high fuel loads exist in the some parts of the USFS and some private land. Due to past fire suppression actions, the watershed had the potential for large scale, high intensity, stand replacing wildfires that can then result in increased sediment delivery to stream channels (USFS and USBLM 1994). Since the late 1990s, the USFS has implemented prescribed burning and mechanical methods to reduce the potential for high intensity fires. We rated fire management as a Medium threat in this watershed for all life stages except eggs that are vulnerable to fine sediment delivery from large fires.

Large flood events and drought are the greatest threat to this highly erosive watershed. Past flood events in 1955 and 1964 have had devastating effects to salmonid habitat by filling pools that are required in the summer for both adults and juvenile steelhead. These floods have also reduced canopy levels further impacting suitability stream temperatures for rearing juvenile salmonids. Future drought conditions can reduce migration potential for both winter and summer spawners (if passage was provided at Scott Dam) and reduce suitability of stream temperatures in the spring and summer through reductions in snowpack and subsequent runoff. The future threat of severe weather patterns was rated as a high threat overall to life stages and watershed processes, due to the high erosion potential and road density in this basin.

Cannabis production is a serious and growing threat in this watershed and other watersheds in this area. In the Outlet Creek watershed which has similar cannabis production issues, LeDoux-Bloom and Downie (2008) documented that diversion from large grow operations resulted in dry channels, stranded or dead juvenile salmonids, and a reduction in migration due to these impacts. During 2010 summer steelhead surveys in the Middle Fork Eel River, CDFG biologists noted increased cannabis operations (S. Harris, CDFW, personal communication, 2010), and biologists conducting field surveys in the Black Butte River report similar activities (L. Morgan, USFS, personal communication, 2011). These large (thousands of plants) illegal grow operations require water diversions to supply plants during the summer growing season. This threat is likely to continue and become an increased source of stress on baseflow and water quality for juvenile salmonids over the next decade.

The USFS fuels reduction and timber harvesting is likely to continue, but these actions are generally limited in size and represent a very small percentage of the watershed. These timber harvest activities are also much improved from past practices that led to unstable slopes and reduced LWD recruitment, therefore, the threat of future timber harvesting in this watershed was rated as Low.

Limiting Stresses, Life Stages, and Habitats

Threat and stress analysis within the CAP workbook suggests adult and juvenile passage is likely limiting steelhead recovery in the Upper Eel River watershed. Almost 100 years of passage obstruction to nearly 200 miles of potential steelhead habitat is the most obvious limiting factor for this population. Secondary to this impact are the ongoing effects of non-native fish competition and predation, effects to the hydrology, and sediment transport, and degradation of habitat from roads and past logging practices.

General Recovery Strategy

In general, recovery strategies will focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Improve Passage and Migration

The Upper Mainstem Eel River steelhead population was once the longest-migrating population in the entire DPS. Restoring access to historical habitat above Scott Dam is essential to recovering this population. Providing access above Scott Dam will require extensive scientific investigations and careful planning regarding the feasibility, engineering strategy, and biological merit of such an endeavor. However, achieving the recovery of this steelhead population will increase the spatial structure (environmental/habitat variation) and diversity (phenotypic/life history types) of the greater Eel River steelhead population and ultimately the NC steelhead DPS in the face of long-term environmental change. For example, coastal summer-run steelhead appear to be derived from local winter steelhead populations, which might retain a genetic legacy that would support re-expression of summer-run steelhead phenotype. However, demonstration of this re-expression would require restoration of suitable habitat conditions (Bjorkstedt *et al.* 2005; Spence *et al.* 2008) within the historical habitat area above Scott Dam. In this example, summer-run steelhead represent the most sensitive steelhead life-history type in the Eel River basin and the potential re-expression of this life-history type in Upper Mainstem Eel River steelhead population is almost certain to contribute to other winter and summer run steelhead populations elsewhere in the Eel River watershed (e.g., North Fork Eel River, Middle fork Eel River, Soda Creek, etc.).

The historical dependency on upper Eel River water diverted to Potter Valley and the Russian River presents significant issues relative to any changes to Potter Valley Project infrastructure that would conceivably provide steelhead access to historical habitat above Scott Dam. Potential solutions to these issues may reside with improving local runoff water storage reliability in Lake Mendocino. Ongoing efforts to improve reliability of Lake Mendocino water storage includes: enhanced forecast informed reservoir operations; changes to streamflow release strategies per the Russian River Biological Opinion (NMFS 2008); changes to the Russian River hydrologic index, and storage capacity within Lake Mendocino by raising Coyote Dam as originally designed. Successful implementation of these strategies and other alternative water conservation measures could alleviate or minimize out-of-basin water supply dependency on upper Eel River water. Additionally, investigations would need to determine how to operate VAFS if viable habitat were to become accessible to steelhead above and within Lake Pillsbury. Moreover, if these investigations or other potential solutions showed that Potter Valley and Lake Mendocino could rely more heavily on local runoff, then preferred strategies to provide habitat accessibility above Scott Dam might be more attainable. Other biological and ecological investigations would also need to be conducted above Scott Dam in efforts to quantify the extent of habitat quantity and quality and to address issues associated with invasive species that reside in Lake Pillsbury.

Reduce the Effects of Severe Weather Patterns

The impacts of large storm events in the past have been exacerbated by roads and timber harvest that were not sensitive to the highly erosive nature of the watershed. The strategy for reducing the potential for mass wasting in this watershed is to upgrade and decommission roads and to avoid unstable areas when proposing timber harvest activities.

Reduce Sediment Delivery from Road Systems

Many of the road systems on USFS lands, private timberlands, and tribal lands need to be upgraded or decommissioned. Road upgrades and stream crossing repair throughout the watershed will reduce fine sediment delivery to streams and reduce the probability of triggering large landslides. As discussed above, the frequency of severe weather patterns is expected to increase, and, therefore, roads in this basin must be disconnected from the stream network or decommissioned to provide resiliency to large flood events that have had devastating effects to salmonid habitat in the past.

Increase Instream Shelter Ratings and Pool Frequency

Improvement in shelter conditions in most stream reaches in the upper Eel River, Rice Fork and tributaries is needed. Due largely to past aggradation, and absence of LWD, quality pool habitat is reduced and shelter components are comprised mainly of cobble and boulder. Restoration efforts should focus on protection of large conifers and riparian areas for future recruitment of LWD to improve shelter, and sediment reduction to improve pool frequency. Restoration efforts would need to occur in tributaries not inundated by Lake Pillsbury, and then focus work on restoring low gradient reaches exposed if dam removal occurs.

Address Water Diversion and Toxic Materials

Reduced flow conditions, and disconnected flow conditions (dry stream channels), water diversions and groundwater pumping must be minimized to protect and increase juvenile steelhead survival. Federal, state and local government representatives should work with landowners to implement creative solutions that minimize these effects; these solutions should examine conservation methods, water management planning, and water storage and recharge solutions in the rural residential areas around Lake Pillsbury. In addition, improved coordination between NMFS, CDFW, USBLM, and USFS and county law enforcement agencies must be implemented to reduce the number of illegal stream diversions within this basin. Additional law enforcement actions to reduce illegal water diversions are expected to reduce the level of toxic materials entering surface waters from cannabis operations. Funding must also be provided for the cleanup of cannabis production sites to minimize future release of toxic material into stream channels.

Improve Migration Barriers

Support USFS staff biologist recommendations regarding migration issues for upstream passage of rainbow/steelhead into rearing habitat of Horse, Trout and Corbin creeks. These barriers documented in the Fish Passage Assessment database should be investigated to determine the potential to improve or restore passage to headwater reaches of this basin.

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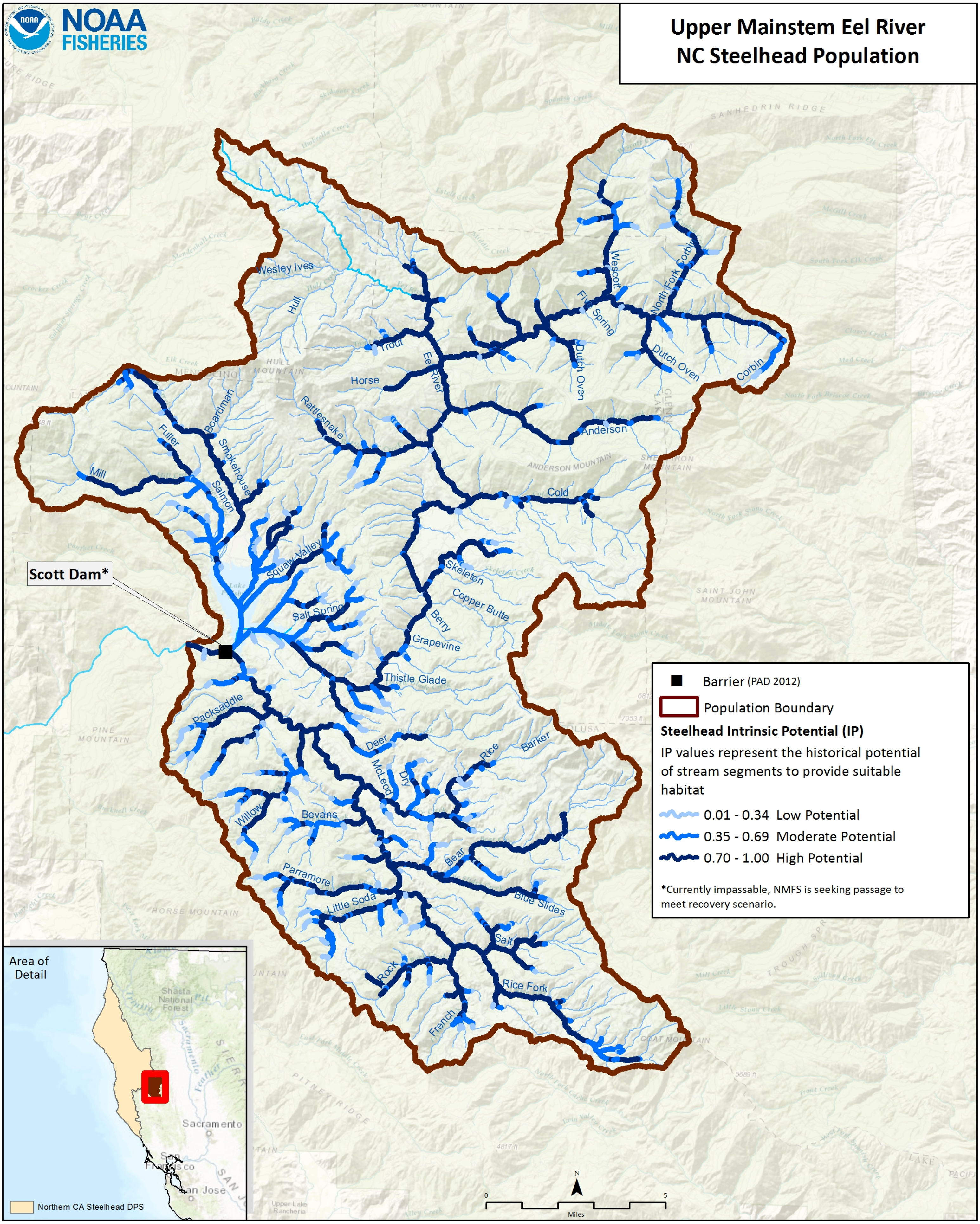
NOAA FISHERIES
Upper Mainstem Eel River
NC Steelhead Population
Scott Dam*
Barrier (PAD 2012)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
*Currently impassable, NMFS is seeking passage to meet recovery scenario.
Wesley Ives
Hull
Trout
Eel River
Horse
Rattlesnake
Boardman
Fuller
Smokehouse
Mill
Salmon
Squaw Valley
Salt Spring
Wescott
North Fork Corbin
Five Spring
Dutch Oven
Corbin
Anderson
Cold
Skeleton
Copper Butte
Berry
Grapevine
Thistle Glade
Packsaddle
Deer
McLeod
Dry
Rice
Barker
Willow
Bevans
Bear
Parramore
Little Soda
Blue Slides
Salt
Rock
Rice Fork
French
SANHEDRIN RIDGE
HULL MOUNTAIN
ANDERSON MOUNTAIN
SAINT JOHN MOUNTAIN
PINE MOUNTAIN
HORSE MOUNTAIN
PITNEY RIDGE
Area of Detail
Shasta National Forest
Sacramento
Northern CA Steelhead DPS
0
5
Miles
N

NC Steelhead Upper Eel River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<5% of IP-Km or <16 IP-Km accessible*	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawners per IP-Km	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		<1 spawners per IP-Km	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-Km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/20% IP-Km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.5 Diversions/10 IP km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	<1466	1,466-146,666	>146,666		Poor	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	Very Good

			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.4 Miles/Square Mile	Fair
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	1.1 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair

			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
			Water Quality	Mainstem Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
		Size	Viability	Abundance					No Population - possible adfluvial	Poor

NC Steelhead Upper Eel River CAP Threat Results

	Threats Across Targets	Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	7	
1	Agriculture	Medium	Low	Low	Low	Low	Low	Low	Low
2	Channel Modification		Low	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition	Medium		High		Medium			Medium
4	Fire, Fuel Management and Fire Suppression	Medium	High	Medium	Medium	Low	Low	Medium	Medium
5	Fishing and Collecting	Medium		Medium		Low		Medium	Medium
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low		Low
8	Logging and Wood Harvesting	Low	Low	Low	Medium	Low	Low	Low	Low
9	Mining		Low						Low
10	Recreational Areas and Activities				Low	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Low	Low	Low	Low	Low	Low
12	Roads and Railroads	High	Medium	Medium	Medium	Low	Medium	Medium	High
13	Severe Weather Patterns	Medium	Medium	Medium	High	Low	Medium	Medium	High
14	Water Diversion and Impoundments	Very High	Low	Medium	High	High	High	Very High	Very High

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UMER-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
UMER-NCSW-3.1.1.1	Action Step	Hydrology	Restore unimpaired flows and access to historical spawning and rearing areas provide off stream storage, conservation and potential water lease or acquisitions.	1	10	CDFW, FERC, NMFS, PG&E, RVIT	
UMER-NCSW-3.1.1.2	Action Step	Hydrology	Investigate and modify operations at the Van Arsdale Fish Station, as appropriate, while considering passage alternatives at Scott Dam.	1	5	CDFW, FERC, NMFS, PG&E, RVIT	
UMER-NCSW-3.1.1.3	Action Step	Hydrology	Investigate the effectiveness of "block water" releases from Scott Dam.	1	5	CDFW, FERC, NMFS, PG&E, RVIT	
UMER-NCSW-3.1.1.4	Action Step	Hydrology	Investigate the effectiveness of current streamflow regimes associated with salmonids and the PVP. Based on the investigation, make any necessary changes to flow requirements during the upcoming FERC relicensing process to ensure PVP effects on streamflow are consistent with recovery of CC Chinook salmon and NC steelhead.	1	10	CDFW, FERC, NMFS, PG&E, RVIT	
UMER-NCSW-3.1.1.5	Action Step	Hydrology	Install a streamflow gage near the mouth of Tomki Creek.	1	10	CDFW, FERC, NMFS, PG&E, RVIT	
UMER-NCSW-3.1.1.6	Action Step	Hydrology	Install flow gages above Lake Pillsbury on the Eel River and the Rice Fork.	1	5	CDFW, FERC, NMFS, PG&E, RVIT	
UMER-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
UMER-NCSW-5.1.1.1	Action Step	Passage	Provide passage over physical barriers that preclude steelhead from accessing important habitat areas above the Bloody Rock high gradient reach on the Eel River.	1	10		
UMER-NCSW-5.1.1.2	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Horse and Trout creeks, and the Upper eel River along the USFS M6 road.	1	5	AC Alliance	
UMER-NCSW-5.1.1.3	Action Step	Passage	Determine the quantity and quality of historic habitat above Scott Dam, including conditions within Lake Pillsbury.	1	3	CDFW, NMFS, Private Landowners, USFS	
UMER-NCSW-5.1.1.4	Action Step	Passage	Investigate the feasibility of decommissioning and removal of Scott Dam.	1	5	CDFW, FERC, NMFS, PG&E	
UMER-NCSW-5.1.1.5	Action Step	Passage	Following physical and biological investigations associated with passage over Scott Dam, provide passage recommendations for the recovery of the Upper Mainstem Eel River steelhead population.	1	5	CDFW, FERC, NMFS, PG&E, USFS	
UMER-NCSW-5.1.1.6	Action Step	Passage	If determined feasible, implement steelhead passage prescriptions or recommendations.	1	5	CDFW, FERC, NMFS, PG&E, USFS	
UMER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
UMER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a plan or priority list that identifies specific stream reaches that would be suitable for conducting instream habitat complexity projects.	2	3	CDFW, NMFS, NOAA RC, PG&E, Private Landowners, USFS	
UMER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement a large woody debris or other large roughness elements supplementation program to increase stream complexity to improve pool frequency and depth.	2	10	CDFW, NOAA RC, USFS	
UMER-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners (private, USFS, and PG&E) to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	1	20	CDFW, Private Landowners, USFS	
UMER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
UMER-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	2	50	CDFW, Mendocino County RCD, NMFS, Private Landowners, USFS	
UMER-NCSW-7.1.1.2	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	50	CalFire, CDFW, County of Mendocino, NMFS, PG&E, Private Landowners, USFS	
UMER-NCSW-7.1.1.3	Action Step	Riparian	Prioritize and fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	10	CDFW, Mendocino County RCD, NRCS, Private Landowners, USGS	

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UMER-NCSW-7.1.1.4	Action Step	Riparian	Develop a riparian restoration plan for tributaries draining into Lake Pillsbury and include restoration of the areas that would be exposed if Scott Dam is decommissioned and removed.	2	3	CDFW, NMFS, PG&E, Private Consultants, Private Landowners	
UMER-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
UMER-NCSW-8.1.1.1	Action Step	Sediment	Investigate the potential effects of sediment transport on stream reaches above, within and below Lake Pillsbury as a consequence of decommissioning and removing Scott Dam	2	3	CDFW, FERC, NMFS, PG&E, Private Consultants, USFS	
UMER-NCSW--10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-10.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment				
UMER-NCSW-10.1.1.1	Action Step	Water Quality	Develop and fund a feasibility study to address the significant turbidity issues from Lake Pilsbury/Scott Dam outlet	2	2	CDFW, NMFS, PGE	
UMER-NCSW-10.1.1.2	Action Step	Water Quality	Fund and implement recommendations from proposed feasibility study to address significant turbidity issues from the Lake Pilsbury/Scott Dam outlet.	2	5	CDFW, NMFS, PGE	
UMER-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
UMER-NCSW-11.1.1.1	Action Step	Viability	Expand salmonids and pikeminnow monitoring within and around the PVP area; including, juvenile outmigrant sampling around VAFS	2	10	CDFW, FERC, NMFS, PG&E	
UMER-NCSW-11.1.1.2	Action Step	Viability	Continue monitoring of adult and juvenile steelhead at the Van Arsdale Fish Station. Explore the need to extend the operations of VAFS to monitor summer steelhead.	2	10	CDFW, FERC, NMFS, PG&E	
UMER-NCSW-11.1.1.3	Action Step	Viability	Conduct spawning surveys to determine habitat use above the Van Arsdale Fish station. Include the assessment of conditions for summer steelhead in this work.	3	10	CDFW, FERC, NMFS, PG&E, Private Landowners	
UMER-NCSW-11.1.1.4	Action Step	Viability	Investigate juvenile steelhead migratory patterns through the Van Arsdale diversion facility. consider utilizing radio telemetry equipment to conduct study.	3	3	CDFW, NMFS, PG&E	
UMER-NCSW-11.1.1.5	Action Step	Viability	Analyze existing tissue samples collected in drainage basins above Scott Dam to assess existing genetic structure of an adfluvial steelhead population.	2	3	CDFW, NOAA SWFSC, PG&E	
UMER-NCSW-14.1	**Objective**	**Disease/ Predation /Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-14.1.1	Recovery Action	Disease/ Predation /Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
UMER-NCSW-14.1.1.1	Action Step	Disease/ Predation /Competition	Reduce predation and competition of pikeminnow on juvenile steelhead by removing/reducing pikeminnow populations	2	20	CDFW, NMFS, PG&E	
UMER-NCSW-14.1.1.2	Action Step	Disease/ Predation /Competition	Support investigations that determine the most effective methods to control the pikeminnow population.	2	5	CDFW, FERC, NMFS, PG&E	
UMER-NCSW-14.1.1.3	Action Step	Disease/ Predation /Competition	Implement the most cost effective methods or programs of pikeminnow control in the Upper Eel River watershed.	2	10	CDFW, PG&E	
UMER-NCSW-14.1.1.4	Action Step	Disease/ Predation /Competition	In coordination with the investigation to decommission and remove Scott Dam, develop alternatives to eradicate non- native fish from Lake Pillsbury.	2	3	CDFW, FERC, NMFS, PG&E	
UMER-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
UMER-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
UMER-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations to aide in managing forest fuel loads in a manner consistent with historical parameters.	3	3	CalFire, Private Landowners, USFS	

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UMER-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Work with private landowners to reduce fuel loads in the Upper Mainstem Eel River watershed.	2	25	CalFire, Private Landowners, RWQCB	
UMER-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Work with USFS to reduce fuel loads in the Mendocino National Forest.	2	30	NMFS, USFS	
UMER-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
UMER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
UMER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead by increasing law enforcement.	3	10	CDFW Law Enforcement, NMFS OLE, USFS	
UMER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work CDFW to minimize or curtail trout fishing in tributaries that drain into Lake Pillsbury.	3	20	CDFW, NMFS, USFS	
UMER-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
UMER-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CDFW, NMFS, Private Landowners, RWQCB, USFS	
UMER-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement road upgrades at high priority sites or systems.	2	20	CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners, USFS	
UMER-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade USFS roads that are used for public or administrative use. Decommission roads in the Mendocino National Forest based on USFS prioritization.	1	10	CDFW, NMFS, RWQCB, USFS	
UMER-NCSW-23.1.1.4	Action Step	Roads/Railroads	Work with the Lake and Glenn County DOTs to upgrade existing high priority riparian road segments.	2	10	County of Mendocino, CDFW, NMFS	
UMER-NCSW-23.1.1.5	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority roads, or those identified in a sediment reduction plan.	2	10	CDFW, NMFS, Private Landowners	
UMER-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UMER-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to watershed hydrology				
UMER-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Investigate the benefits of increasing the storage of Coyote Valley Dam to reduce the need for Scott Dam and improve the historic flow regime and habitat availability in the upper mainstem Eel River..	2	3	CDFW, Corps, MCRRFCD, NMFS, Sonoma County Water Agency	

Van Duzen River Population

NC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 6,200 adults
- Current Intrinsic Potential: 312.2 IP-km

NC Steelhead Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: Effective Population Size; $N_e \geq 500$
- Amount of Potential Habitat: NA

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

There are two natural barriers on the mainstem of the Van Duzen River that limit passage of adult steelhead (CDFG 2012a). Salmon Falls, at River Mile 36.7 near the confluence of Bloody Run Creek, and Eaton Roughs located at River Mile 46. Adult steelhead are able to pass Salmon Falls under most conditions but are generally unable to pass Eaton Roughs in most years. One steelhead has been documented upstream of Eaton Roughs, based on genetic sampling (Brett Harvey, USFS, personal communication, May 12, 2016). Much of the Little Van Duzen River is accessible to steelhead as well.

There are limited, inconclusive data documenting winter steelhead abundance in the Van Duzen River (CDFG 2012b). Anglers self-report catch and release of wild steelhead using the Steelhead Report Card. The number of wild adults released from 2000 to 2006 was below 100 each year; from 2007-2010 the number has generally increased and ranged from 180 to 403 (Table 1; F. Bajjaliya, CDFW, personal communication, January 23, 2015). The proportion of fish caught that were summer steelhead vs. winter steelhead is unknown. The number of adult summer steelhead observed during a 20-mile survey of steelhead holding pools on the Van Duzen River from Eaton Roughs to Little Larabee Creek has varied since 1979. From 2011 to 2014 (next most recent year was 1997), counts have ranged between 81 and 255 adults with the peak in 2012, and averaged 152 fish per year (Table 2) (Shaun Thompson, CDFW, personal communication, January 22, 2015).

These numbers are much lower than estimates of over 2,000 fish in the Little Van Duzen alone prior to the 1964 flood (CDFG 2012a).

History of Land Use

Historically, the Van Duzen River basin consisted primarily of late-seral redwood/Douglas-fir (coniferous) forests with limited open oak woodland/prairies farther inland at higher elevations. Beginning near the turn of the twentieth century, logging led to development of hardwood-dominated forests and reduced large wood recruitment potential to streams (CDFG 2012a). In addition, floodplain and estuarine wetland areas were cleared, diked, and drained to provide land for agriculture and urban development. Technological developments after World War II enabled logging and road building in steeper, more landslide prone areas. This caused excessive sediment delivery to streams, especially following large floods in 1955 and 1964, resulting in shallow pools and wide streams. Sacramento pikeminnow (*Ptychocheilus grandis*) were accidentally introduced to Lake Pillsbury in 1980 (CDFG 1997), and are presumed to have colonized all accessible reaches of the Eel River watershed. Past gravel mining in the Lower Eel River likely contributed to braiding and flattening of the Eel River between the confluence with the Van Duzen River to one mile downstream of Fernbridge (Humboldt County Department of Public Works 1992).

Rural residences, small ranches, and agriculture have increased the demand for water. Currently, much of this demand is accommodated through instream diversions or shallow wells, which have lowered streamflows during summer low-flow periods.

Current Resources and Land Management

About 18 percent of the Van Duzen River basin is under Federal ownership, and the remaining 82 percent is owned by private entities. Of this 82 percent, 15 large ranches make up 30 percent of the land, industrial timberlands make up 27 percent, and small private rural developments make up 25 percent (CDFG 2012a).

Several watershed groups are active in the basin: the Eel River Watershed Improvement Group, Friends of the Eel River, Friends of the Van Duzen River, Eel River Recovery Project, and the Yager/Van Duzen Environmental Stewards. NMFS considered the following existing management plans and other documents, which identify actions to improve conditions in the Van Duzen River basin, during preparation of this document.

- Recovery Strategy for California CCC Coho Salmon (CDFG 2004);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997);
- Van Duzen Basin Assessment Report (CDFG 2012a);
- Lower Eel River Watershed Assessment (CDFG 2010);
- Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment (USEPA 1999);
- Lower Eel River Total Maximum Daily Loads for Temperature and Sediment (USEPA 2007);
- Green Diamond Resource Company (GDRC) Aquatic Habitat Conservation Plan (GDRC 2006);
- Humboldt Redwood Company Habitat Conservation Plan (HRC 2012); and
- Yager-Lawrence Watershed Analysis (HRC 2009).

Viability and Watershed Conditions

NMFS rated the following indicators as Poor for steelhead through the CAP process (see Van Duzen CAP results): Passage flows at the confluence with the Eel River, quality and extent of estuary habitat, canopy cover, primary and staging pools, baseflow, diversions, gravel quality, quantity, and distribution, gravel embeddedness, shelter, turbidity, extent of timber harvest, road density, and streamside road density. Other indicators that warrant habitat restoration because they were rated "Fair" are: frequency of large wood, the ratio of pools to riffles and flatwater, size of riparian trees (tree diameter), spawning gravels, floodplain connectivity, toxicity, population density, redd scour, instantaneous flow conditions, passage flows, passage at the mouth for smolts, floodplain connectivity, water temperature, and abundance of smolts and summer steelhead adults.

The recovery strategy focuses on improving the habitat conditions described by these indicators. Strategies that address other indicators are developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion elaborates on those conditions that rated Fair or Poor in our CAP viability analysis. The Van Duzen River CAP Viability Table results are described below. Recovery strategies will focus on improving these conditions.

Unless otherwise noted, conditions are assessed in all areas utilized by steelhead in the Van Duzen River, including the lower Eel River downstream of the confluence with Van Duzen River and the Eel River estuary.

Sediment: Gravel Quality and Distribution of Spawning Gravels

The EPA listed the Van Duzen River and the Lower Eel rivers as impaired by sediment (USEPA 1999 and 2007). The Eel River is one of the most erodible watersheds in the United States (Brown and Ritter 1971) because of the active tectonic setting, highly erodible soils, and high precipitation. The Eel River carries 15 times as much sediment as the Mississippi River, and more than four times as the Colorado River (Brown and Ritter 1971). Anthropogenic activities in the Eel and Van Duzen rivers have exacerbated these naturally high sediment loads. A study of the continental shelf deposits offshore from the mouth of the Eel River indicates that there has been a sudden, three-fold increase in the rate of sedimentation since 1954 (USEPA 2007).

Fine sediment loads are very high in much of the Van Duzen (USEPA 1999; HRC 2009; CDFG 2012a) and Lower Eel rivers (USEPA 2007; CDFG 2010), leading to embedded gravels and a small average particle size. Sedimentation of spawning gravel throughout much of the Van Duzen River watershed is a limiting factor to steelhead production (CDFG 2012a).

NMFS rated sediment conditions as Poor for eggs, adult summer steelhead, and juveniles rearing in the summer and winter. Eggs may fail to hatch if excessive sediment loads keep oxygen from reaching them (CDFG 2012a). Adult summer steelhead hold in deep pools over the hot summer months; sediment reduces the depth of these pools. Juveniles and presmolts also rely on pools for shelter, and feed on insect prey produced in riffles upstream of pools. Insect production can be impaired by excess sedimentation on these riffles (CDFG 2012a). Aggradation has interrupted the connectivity of surface flow in several areas. The Van Duzen River is often isolated from the Eel River by subsurface flows in late summer and early fall, affecting movement of juvenile steelhead. An overabundance of sediment is deposited at the confluence of the Van Duzen and Eel rivers each year, which results in sub-surface flows and dry channels (CDFG 2010).

The naturally highly erosive soil in the Van Duzen watershed, combined with steep slopes and dormant landslides resulting from prior land use, leads to higher risk of shallow landslides and debris slides (CDFG 2012a). Treatment of past landslides, and prevention of future ones, is important to reduce sediment delivery to the Van Duzen River and its tributaries. Unstable banks are also sources of sediment delivery.

Habitat Complexity: Large Wood and Shelter

Surveys conducted by CDFW indicate that shelter ratings are very poor throughout the population area, with 3 percent of surveyed streams meeting desired levels for shelter and LWD (SEC 2012). Habitat complexity conditions have an overall rating of Poor for steelhead summer rearing juveniles, winter rearing juveniles, smolts, and adult summer steelhead. Habitat complexity is reduced by a deficit of large wood and a large supply of sediment (CDFG 2012a).

Viability: Density, Abundance, and Spatial Structure

There are an estimated 3,000-5,000 adult winter steelhead in the Van Duzen River annually (S. Downie, CDFW, personal communication, August 3, 2012). Viability conditions were Fair for winter adults, summer rearing juveniles, smolts, and adults (although rated Good for spatial structure, as the various life stages are well distributed throughout their historic habitat). In order to achieve a low risk of extinction, there should be at least 6,340 steelhead adults in the Van Duzen River each year. There is no defined target number of adult summer steelhead for the Van Duzen River, but the numbers observed from 2011 to 2014 were far less than observed before the 1964 flood (CDFG 2012a).

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Available data indicate that there are not enough suitable juvenile rearing pools or adult holding pools in the Van Duzen River (CDFG 2012a) and the Yager and Lawrence Creek watersheds of the Van Duzen River (HRC 2009). Many pools are too shallow due to excessive sediment inputs (CDFG 2012a), and those pools available for juvenile use provide insufficient number and diversity of cover elements such as undercut banks, woody debris, and root masses (SEC 2012). Pools in the Van Duzen River are often shallower than is optimal for steelhead use, likely due to excessive sediment loading (CDFG 2012a). The impacts of reduced pool volume and complexity are exacerbated by the presence of predatory Sacramento pikeminnow, which further limits the use of pools by juvenile steelhead rearing.

Water Quality: Temperature

High water temperature is common during the summer in the mainstem Van Duzen River and many of its tributaries, which affects rearing juvenile steelhead (CDFG 2012a). Water temperature is also a problem in the summer in the mainstem Eel River (CDFG 2010; USEPA 2007), affecting juveniles, smolts and adult summer steelhead, which all use the area for rearing and passage. The Lower Eel River is listed as temperature-impaired under section 303(d) of the Clean Water Act (USEPA 2007). Water quality concerns in the Lower Eel River are further described in the profile for the South Fork Eel/Lower Eel River in this document.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of Eel River steelhead populations. The Eel River estuary is currently severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. Please see the NC steelhead Eel River Overview for a complete discussion of estuarine conditions and needed recovery actions for this area.

Riparian Vegetation: Composition, Cover & Tree Diameter
NMFS rated tree diameter as Fair overall because much of the Van Duzen River is forested with moderate-sized trees, and rated species composition as Very Good because the watershed is estimated to have 75 percent intact historical riparian species. However, many areas of the lower Eel River have poor canopy cover, which falls short of the 80 percent shade canopy target value used by CDFW (CDFG 2010) to assess habitat condition relative to the target.

Sediment Transport: Road Density
There are an average of 6.8 miles of road per square mile of land in the Van Duzen watershed, leading to a rating of Poor. Most of these roads are associated with timber harvest activities and rural residences. USEPA (2009) found that half of the human-caused sediment loading in the watershed was due to roads.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization
Landscape Pattern conditions have an overall rating of Poor because at least one land-disturbing activity occurs in all areas of the watershed: Road density is high across the watershed, forestry occurs over much of watershed, and ranching occurs in some areas. The impact of this disturbance is compounded by the highly erosive soil in the Van Duzen River watershed (CDFG 2012a).

Hydrology: Baseflow and Passage Flows
NMFS rated baseflow and passage flows as Poor for summer rearing juvenile and adult summer steelhead. Summer flow conditions in the mainstem Eel River are poor, and flow in the Van Duzen River in late summer is likely lower than historic conditions. Reduced summer flows in the mainstem Eel River and the Van Duzen River can be partly attributed to increased evapotranspiration rates resulting from replacement of old-growth forests with younger forests (Perry 2007). Reduced flows also likely reflect increased water diversions to support medical marijuana cultivation (S. Bauer, CDFW, personal communication, January 17, 2013). Reduced flows can result in shallower pools and increased water temperature, and can impair steelhead movement. If reaches dry up, the amount of habitat available to steelhead is reduced and passage of smolts and adults may be impaired or stopped (CDFG 2010). The poor water quality conditions resulting from low flows favor the pikeminnow, which preys upon juvenile steelhead.

Water Quality: Turbidity or Toxicity

Extended periods of high turbidity after rain events have been documented in Cummings Creek, Grizzly Creek, Wolverton Gulch, and other areas of the Van Duzen basin (CDFG 2012a). Turbidity levels high enough to affect salmon health (>25 NTU) were documented in several tributaries of the Van Duzen River from 2000 to 2003 (Harkins 2004). The Loleta wastewater treatment facility accepts both municipal wastewater and wastewater from the Humboldt Creamery and the Loleta Cheese Factory. This facility discharges into percolation/evaporation ponds on the Eel River, and in the winter, these ponds overflow into the Eel River (CDFG 2010).

Hydrology: Redd Scour

NMFS rated redd scour conditions as Fair for eggs in the Van Duzen River. CDFG (2012a) found that peak flows might be more extreme in the Van Duzen River than in past due to timber harvest and other land alterations, which may have accelerated the rate at which rainwater runs off the land. These flows can destroy steelhead redds.

Hydrology: Impervious Surfaces and Diversions and Impoundments

The proportion of the Van Duzen River watershed covered by impervious surfaces is low (SEC 2012). The number of diversions in the Van Duzen River is unknown but could be increasing due to the medical marijuana industry (see rating of threat of diversions as High). Water diversion and impoundments pose a High threat to summer rearing juvenile and adult summer steelhead.

Threats

The following discussion focuses on those threats NMFS rated High or Very High (see Van Duzen CAP Results). Recovery strategies will likely focus on ameliorating these threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts.

Unless otherwise noted, threats are assessed in all areas utilized by fish originating in the Van Duzen River, including the lower Eel River (downstream of the confluence with Van Duzen River) and the Eel River estuary.

High or Very High Rated Threats

Channel Modification

Actions that modify or disrupt the natural channel-forming processes and morphology of the Lower Eel River and its estuary have degraded habitat utilized by steelhead. Dikes and levees were constructed in the estuary in order to restrict flow and reclaim tidelands. Please see the NC steelhead Eel River Overview for a complete discussion of this threat and associated recovery actions.

Water Diversion and Impoundments

Water diversion and impoundments pose a High threat to summer rearing juvenile and adult summer steelhead. As of July 2010, there were 25 licensed, permitted, or pending water rights within the Lower Eel basin (estuary to River Mile 21) and lower Van Duzen River (CDFG 2012a); this is not a complete number of diversions because it does not include users of riparian rights and other diversions that are not registered with the State Division of Water Rights. Diverted water is used to water row crops and home gardens, for watering cattle, and for domestic and municipal use by the cities of Fortuna and Rio Dell. Marijuana cultivation has become locally abundant in the Van Duzen River (CDFG 2012a), and the water diversion required to support these plants is placing a high demand on a limited supply of water (S. Bauer, CDFW, personal communication, January 17, 2013). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per season (Humboldt Growers Association 2010). Diversions affect flow in the Eel River and Van Duzen River, and impact steelhead by degrading instream habitat conditions. The effects of reduced flow on steelhead are described under the stress "Hydrology: Baseflow and Passage Flows."

Disease, Predation and Competition

The invasive Sacramento pikeminnow is common in some areas of the lower Eel River basin (CDFG 2010) and is abundant in some locations of the mainstem Van Duzen River and in Yager Creek (CDFG 2012a). This species preys upon and competes with juvenile steelhead. The life stages most affected are summer rearing juvenile steelhead, and smolts. Removal of pikeminnow has been unsuccessful in the Eel River (CDFG 2012a). Pikeminnow prefer warmer water than steelhead do (Bettelheim 2001), so reducing water temperature to match steelhead habitat requirements would make the habitat less suitable to pikeminnow and may help control the species.

Roads and Railroads

As described under the "Sediment Transport: Road Density" stress in this document, high road density in the Van Duzen River and the lower Eel River is problematic for recovery of steelhead in these areas due to its effects on watershed processes. Roads can also alter the hydrology of stream systems, resulting in higher peak flows (Ziegler *et al.* 2002).

Fishing and Collecting

Fishing is a High threat to adult summer and winter steelhead. There is a popular catch-and-release fishery targeting summer steelhead in the Eel River that attracts hundreds of anglers every season. California sport fishing regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration. Sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1 of each year, which allows anglers to target adult summer steelhead staging in low flow conditions during September. The low flow season expires on January 31, which also leaves adults vulnerable to fishing pressure during low flows occurring on or after February 1. Adult steelhead are easy targets for anglers and poachers in these extremely low flows. Poor water quality in September stresses the fish and likely results in increased hook-and-release mortality (Clark and Gibbons 1991). Based on self-reported steelhead angling data, some of these fish are not only subject to the stress of capture and release but are removed from the system entirely; recreational fishermen reported keeping adult wild steelhead in eight out of twelve years from 2000 to 2012 (Table 1).

Low or Medium Rated Threats

Livestock Farming and Ranching

The irreversibility of the stresses (Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater ratios; Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels) that result from this threat is generally Low, leading to an overall Medium threat rating. Cattle grazing, the predominant land use in the delta grasslands, has been a major factor in the degradation of habitat and reduced floodplain connectivity in the Lower Eel and estuary. Ongoing impacts include degradation of water quality by cattle waste and erosion of stream banks and damage to riparian vegetation where cattle have unrestricted access to streams. Diversions for livestock watering are considered in the 'Water Diversions and Impoundments' threat.

Logging and Wood Harvesting

Timber harvest is a dominant land use in the basin (CDFG 2012a). The rate of timber harvest on California's north coast has generally decreased over the last 25 years, but in the Van Duzen River basin, the acreage harvested has increased since 1990 (CDFG 2012a). Timber harvest has numerous effects on steelhead habitat, including reduced recruitment of large wood into streams, reduced instream habitat complexity, reduced shade that can lead to increased water temperature, and increased sedimentation. USEPA (1999) found that half of the anthropogenic sediment loading in the Van Duzen River was due to timber harvest. Much of the forested lands are managed under Habitat Conservation Plans held by Humboldt Redwood Company and Green Diamond Resource Company. The conservation measures in these HCPs (GDRC 2006; HRC 2012) are generally more protective of steelhead habitat than the regulations that would otherwise apply at the time the HCPs were finalized. California's Forest Practice Rules (CFPR) regulate timber harvest on all private lands. NMFS is working collaboratively with the California

Board of Forestry to limit the effects of forestry operations on threatened and endangered steelhead populations in California through the CFPR. At this time, however, the rules do not fully address the limiting factors for steelhead.

Agriculture

Agriculture as defined for this plan excludes ranching, which is a separate threat. Some row crops are planted and pasture grasses are bailed for winter feed in the lower Eel River (CDFG 2012a), and marijuana cultivation has become locally abundant in the Van Duzen River (CDFG 2012a), but aside from associated water diversions agricultural impacts are of minor impact to steelhead and their habitat. Water diversions to support this agriculture are considered under the 'Water Diversions and Impoundments' threat.

Residential and Commercial Development

Several small towns lie within the Eel River watershed downstream of the Van Duzen River, and the town of Fortuna is the population center in the area. About 12,500 people lived in this area (represented by the principal communities of Ferndale and Fortuna) when the 2004 census was conducted (CDFG 2010). Rural residences also occur elsewhere in the basin. Diversions to support these communities are considered under the 'Water Diversions and Impoundments' threat, and roads associated with these communities are considered under the 'Roads' threat, both elsewhere in this document.

Hatcheries and Aquaculture

There are currently no hatcheries or fish collecting operations in the Eel River or Van Duzen River basin. Adult steelhead originating from hatcheries elsewhere (*e.g.*, Mad River) sometimes stray to the Eel River and the Van Duzen River and are caught by recreational anglers (F. Bajjaliya, CDFG, personal communication, July 24, 2012). These hatchery fish likely have a minor effect on steelhead in the Van Duzen River. Based on self-reported steelhead report card data, these hatchery fish made up from 2% to 81% of the total steelhead caught from 2000 to 2012, and hatchery fish made up at least half of the number of fish captured from 2000 to 2012 (Table 1).

Mining

Gravel extraction occurs in the Lower Eel River as well as the Van Duzen River from the mouth upstream to Eaton Falls. These operations are conducted with State and Federal oversight. The Medium threat rating reflects sensitivity of the channel to future disturbances (*i.e.*, lack of floodplain and channel structure). Certain gravel extraction trenching methods have been used successfully to address some of the problems associated with the high sediment load in the lower Eel River, including the adult migration barrier that develops at the Van Duzen/Eel River confluence. Current gravel mining methodologies accommodate the narrowing and deepening of channels by using wet trenching techniques.

Recreational Areas and Activities

Recreational activities such as biking, hiking, and equestrian uses occur in the Van Duzen watershed but likely have a minimal impact on steelhead habitat. In 2010, the U.S. Forest Service approved a motorized travel management plan for the Six Rivers National Forest, including land in the headwaters of the Van Duzen River (USFS2010). This plan minimizes potential resource damage resulting from use of motorized vehicles in the national forest. Recreational fishing is considered under the "Fishing and Collecting" threat.

Severe Weather Patterns

Floods and droughts constitute a low threat to steelhead in the Van Duzen River basin and the lower Eel River areas they utilize. Sea-level rise associated with climate change is likely to affect Van Duzen River steelhead by reducing the amount of habitat available to steelhead in the Eel River estuary. The amount of sea-level rise expected to occur in the next ten years poses a low threat to steelhead.

Limiting Stresses, Lifestages, and Habitats

Juveniles and adult summer steelhead are limited by poor rearing conditions during the summer months caused by high water temperature in the lower Eel River, inadequate pools throughout the Van Duzen River and lower Eel River that do not have enough cover and are too shallow, and reduced and degraded estuarine habitat. Fine sediments negatively impact existing habitat throughout both basins. Further, water diversions reduce instream flow in the lower Eel River, exacerbating water temperature issues and limiting passage of juvenile and adult steelhead.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may be developed where their implementation is critical to restoring properly functioning habitat conditions. The recovery strategy for the Van Duzen River populations is discussed below, with more detailed and site-specific recovery actions provided in the Implementation Schedule (see Van Duzen CAP results).

Restore Access to Habitat

Barriers to fish passage do not present a major impediment to restoration and recovery, as reflected by their low stress ranking. However, many tributaries to the mainstem Eel River become disconnected and inaccessible in the summer months due to sediment deposition and the resulting sub-surface flows. If the tributaries were accessible, they would provide refuge currently very limited in the Eel River mainstem reaches.

Investigate and Address Water Diversion and Groundwater Extraction and Ensure Instream Flows Are Sufficient

In the Lower Eel and Van Duzen rivers, diversions likely limit steelhead production by impeding passage and degrading habitat to the extent that fish die. Instream flows should be increased during the summer months by providing incentives to reduce diversions during the summer, establishing a forbearance program using water storage tanks to decrease diversions during periods of low flow, creating water budgets to avoid over-allocating water diversions, and ensuring that General Plan or City ordinances account for steelhead habitat needs.

Increase Habitat Complexity

Pools in the Van Duzen and Lower Eel rivers are too simplified and shallow to support steelhead growth and survival. Large wood, boulders, or other instream structure should be added (especially in areas with cool water) in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be restored in the Van Duzen River and its tributaries and in lower Eel River tributaries.

Reduce Water Temperature

High water temperatures limit growth and survival of juvenile steelhead. In streams with insufficient stream canopy, riparian vegetation should be managed to increase shade. Livestock fencing should be used to protect riparian vegetation from cattle to maintain existing shade from this vegetation. Instream flows should be sufficient so that they do not contribute to excessive water temperature.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor steelhead habitat conditions. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance that minimizes effects on steelhead habitat should be developed for building and maintenance of private roads.

Improve Fishing Regulations

The recreational fishery impacts steelhead on the Eel River, including fish headed for the Van Duzen River. The effects of this fishery on these species should be determined, and regulators should consider changes to regulations to protect this species during low flows.

Table 1: Number adult steelhead encounters reported through CDFW's Steelhead Report Card, including outcome (number kept and released) (Source: F. Bajjaliya, CDFW, personal communication, January 23, 2015).

Year	Wild kept	Wild released	Hatchery kept	Hatchery released
2000	0	5	7	1
2001	3	5	0	34
2002	0	18	1	5
2003	2	90	3	4
2004	0	94	0	9
2005	0	43	0	0
2006	3	11	6	23
2007	3	208	1	3
2008	2	180	1	24
2009	4	256	0	37
2010	0	215	4	20
2011	0	278	2	50
2012	0	403	0	23

Table 2: Number adult steelhead observed during 20 mile survey of steelhead holding pools on the Van Duzen River from Eaton Roughs to Little Larabee Creek (Source: S. Thompson, CDFW, personal communication, January 22, 2015).

Year	Number adult steelhead observed
1979	31
1980	25
1982	8
1984	58
1987	52
1997	15
2011	110
2012	255
2013	162
2014	81

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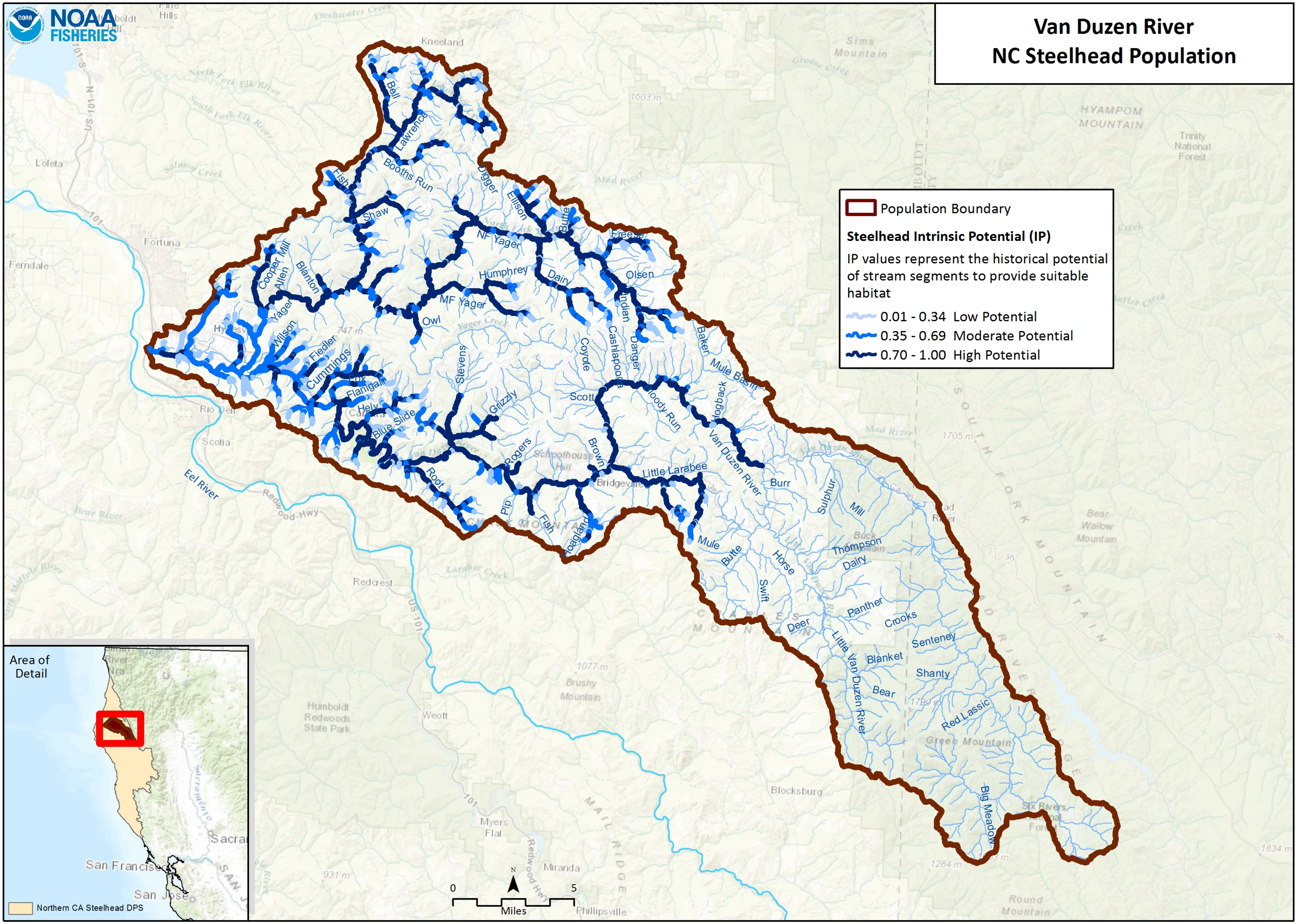

Van Duzen River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
0
5
Miles

NC Steelhead Van Duzen River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good

			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-129	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	<50% of streams/ IP-Km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor

			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.36	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	<50% of streams/ IP-Km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-130	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good

			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.37	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-131	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2012)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	10-19% of Watershed in Agriculture	Fair
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	>35% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	>75% Intact Historical Species Composition:	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	>3 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	>1 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	<50% of streams/ IP-Km (>20% staging pool frequency)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Poor

			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-132	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
		Size	Viability	Abundance					<1 Spawner per IP-km, Spence 2012)	Fair

NC Steelhead Van Duzen River CAP Threat Results

Threats Across Targets		Winter Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Summer Adults	Overall Threat Rank
Project-specific-threats		1	2	3	4	5	6	7	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Medium	Medium
2	Channel Modification	Low	Low	High	Medium	High	Medium	Medium	High
3	Disease, Predation and Competition	Low	Low	High	Low	High		Medium	High
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Medium	Medium
5	Fishing and Collecting	High		Low		Low		High	High
6	Hatcheries and Aquaculture								
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Medium	Medium	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Medium	Medium	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Medium	Medium
11	Residential and Commercial Development	Low	Medium	Medium	Low	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	High	Medium	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	High	Low	Medium	Medium	High	High

Van Duzen River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
VaDR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
VaDR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
VaDR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Develop plan to create off-channel ponds, alcoves, and backwater habitat.	1	5	NGO	
VaDR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Create habitat guided by plan.	1	5	NGO	
VaDR-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
VaDR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
VaDR-NCSW-3.1.1.1	Action Step	Hydrology	Ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB	
VaDR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
VaDR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
VaDR-NCSW-5.1.1.1	Action Step	Passage	Develop and implement plan to address partial sediment barrier at mouth of Hely Creek.	2	10	NGO	
VaDR-NCSW-5.1.1.2	Action Step	Passage	Develop and implement plan to address partial sediment barrier at mouth of Root Creek.	2	10	NGO	
VaDR-NCSW-5.1.1.3	Action Step	Passage	Develop and implement plan to address barrier at Wolverton Gulch.	3	10	NGO	
VaDR-NCSW-5.1.1.4	Action Step	Passage	Develop and implement plan to address barrier at confluence of Van Duzen River with Cummings Creek.	2	10	NGO	
VaDR-NCSW-5.1.1.5	Action Step	Passage	Develop and implement plan to address barrier at confluence of Van Duzen River with Fiedler Creek.	2	10	NGO	
VaDR-NCSW-5.1.1.6	Action Step	Passage	Develop and implement plan to address culvert on Highway 36.	2	10	CalTrans	
VaDR-NCSW-5.1.1.7	Action Step	Passage	Develop and implement plan to address culvert on Rohnerville Road.	2	10	County	
VaDR-NCSW-5.1.1.8	Action Step	Passage	Restore passage to all life stages.	2	50	NGO	
VaDR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
VaDR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				
VaDR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop plan to add large wood, boulders, or other instream structure to specific areas in specific quantities.	2	5	NGO	
VaDR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Add structure, guided by plan.	2	5	NGO	
VaDR-NCSW-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**				
VaDR-NCSW-6.2.1	Recovery Action	Habitat Complexity	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
VaDR-NCSW-6.2.1.1	Action Step	Habitat Complexity	Reduce removal of instream large wood (i.e., wood poaching)	2	10	NPS, CDFW, County	
VaDR-NCSW-7.1	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**				
VaDR-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
VaDR-NCSW-7.1.1.1	Action Step	Riparian	Reduce detrimental environmental impacts of conversion of TPZ land to other uses.	2	5	NMFS, Calfire, BOF	
VaDR-NCSW-7.1.1.2	Action Step	Riparian	Work with Calfire and BOF to minimize the number of conversions per landowner	2	5	NMFS, Calfire, BOF	
VaDR-NCSW-7.1.1.3	Action Step	Riparian	Institute environmental review as part of TPZ conversions	2	5	Calfire, BOF	
VaDR-NCSW-7.1.1.4	Action Step	Riparian	Work to ensure effects of activities on converted areas are minimized.	2	5	NMFS, Calfire, BOF	
VaDR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				

Van Duzen River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
VaDR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
VaDR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	1	5	CDFW, NMFS	
VaDR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Title 14, Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers to restrict fishing during low flow periods.	1	5	CDFW, NMFS	
VaDR-NCSW-16.2	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**				
VaDR-NCSW-16.2.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
VaDR-NCSW-16.2.1.1	Action Step	Fishing/Collecting	Work with CDFW to restrict or close the fisheries when flows are low to better protect steelhead.	1	5	CDFW	
VaDR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
VaDR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
VaDR-NCSW-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from areas.	2	5	NGO	
VaDR-NCSW-18.1.1.2	Action Step	Livestock	Work with private landowners to install fence, guided by plan.	2	5	RCD, Private Landowners	
VaDR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**				
VaDR-NCSW-7.1.1	Recovery Action	Riparian	Prevent or minimize adverse alterations to riparian species composition and structure				
VaDR-NCSW-7.1.1.1	Action Step	Riparian	Develop plan that identifies areas in need of more shade that currently support steelhead and describes timber management methods that will increase shade over time.	3	5	NGO	
VaDR-NCSW-7.1.1.2	Action Step	Riparian	Manage forests in identified areas to increase shade, guided by plan.	3	5	Private	
VaDR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**				
VaDR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
VaDR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	3	5	NGO	
VaDR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	5	NGO	
VaDR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	5	NGO	
VaDR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	50	RCD, Private Landowners	
VaDR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Develop and implement a plan to stabilize hillslope at Hely Creek 1,440 feet above Highway 36.	2	2	NGO	
VaDR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
VaDR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
VaDR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	3	100	County	
VaDR-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
VaDR-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
VaDR-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer.	2	5	NGO	

Van Duzen River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
VaDR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Document reduction in diversions and effects on salmonid habitat.	2	5	NGO	
VaDR-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Implement forbearance program.	2	5	NGO	
VaDR-NCSW-25.1.1.4	Action Step	Water Diversion /Impoundment	Create water budgets to avoid over-allocating water diversions.	2	5	RWQCB	
VaDR-NCSW-25.1.1.5	Action Step	Water Diversion /Impoundment	Utilize water budgets when allocating diversions.	2	5	RWQCB	
VaDR-NCSW-25.1.1.6	Action Step	Water Diversion /Impoundment	Conduct a study to document extent of water diversions and the effects these diversions have on salmonids, which includes recommendations for amount of diversions that would not limit recovery of salmonids.	2	5	RWQCB	
VaDR-NCSW-25.1.1.7	Action Step	Water Diversion /Impoundment	Reduce diversions to level that would not limit recovery of salmonids.	2	30	RWQCB	
VaDR-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
VaDR-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
VaDR-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Revise County General Plan as needed to account for salmonid habitat needs and the impacts of marijuana cultivation.	2	5	County	
VaDR-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Revise City ordinances as needed to account for salmonid habitat needs.	2	5	City	

Lower Interior Diversity Stratum

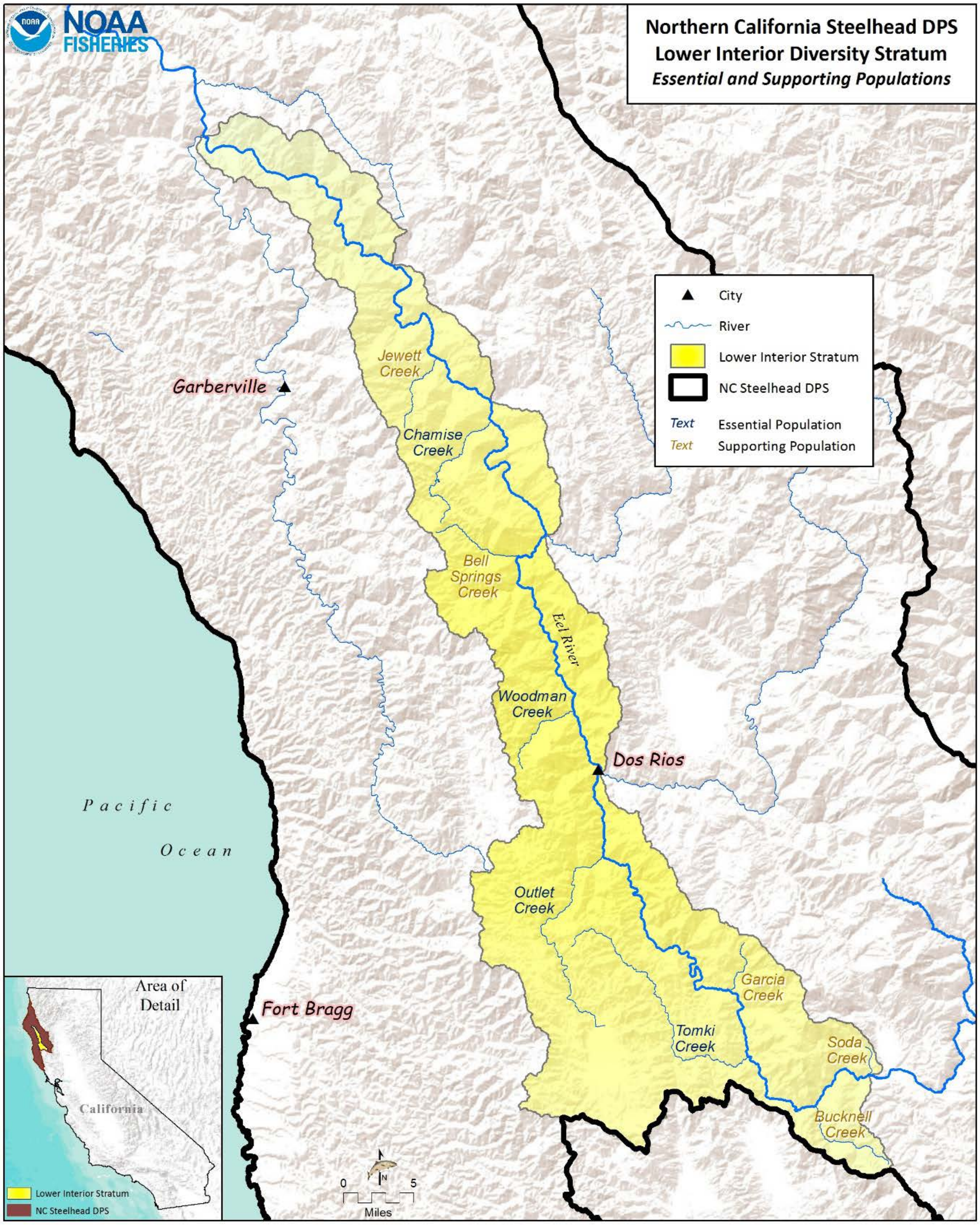
This stratum includes populations of winter steelhead that spawn in watersheds that drain lower elevation mountains in the Klamath Mountains ecoregion for which snowmelt contributes little to the annual hydrograph. Most of these watersheds lie south of the mainstem Eel River, but also include minor tributaries to the mainstem Eel River upstream of the confluence of the South Fork Eel River that drain smaller, somewhat lower watersheds lying on either side of the mainstem Eel River.

The populations that have been selected for recovery scenarios are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum, followed by the Rapid Assessment of the Supporting populations:

- Chamise Creek
- Outlet Creek
- Tomki Creek
- Woodman Creek
- Lower Interior/North Mountain Interior Rapid Assessment
    - Bell Springs Creek
    - Bucknell Creek
    - Dobbyn Creek (North Mountain Interior)
    - Jewett Creek
    - Garcia Creek
    - Soda Creek

NC steelhead Lower Interior Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting.

Diversity Stratum	NC steelhead Populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Lower Interior	Bell Springs Creek	I	Supporting	18.1	6-12	107-215
	Bucknell Creek	I	Supporting	9.0	6-12	52-106
	Chamise Creek	I	Essential	36.2	37.2	1,300
	Jewett Creek	I	Supporting	16.8	6-12	99-200
	Garcia Creek	D	Supporting	14.1	6-12	83-167
	Outlet Creek	I	Essential	176.0	20.0	3,500
	Soda Creek	D	Supporting	15.7	6-12	92-186
	Tomki Creek	I	Essential	89.5	29.8	2,700
	Woodman Creek	I	Essential	35.0	37.4	1,300
	Lower Interior Diversity Stratum Recovery Target					**8,800**



NC steelhead Lower Interior Diversity Stratum

Chamise Creek Population

NC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Lower Interior
- Spawner Abundance Target: 1,300 adults
- Current Intrinsic Potential: 36.2 IP-km

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Adult and juvenile steelhead abundance is not well documented within the Chamise Creek watershed. Becker and Reining (2009) reference a 1983 CDFG report indicating that nine miles of stream within Chamise Creek are accessible to steelhead, although the report was careful to note the estimate represents stream miles "open to fish passage" and is not a "measure of availability or habitat quality". Like other mainstem Eel River tributaries (*e.g*., Woodman Creek), Chamise Creek likely supports a small population of steelhead at the present time (on the order of a few hundred fish), suggesting the current population is much smaller than the estimated historical size of 1,300 spawning adults identified by Spence *et al.* (2012)

Steelhead are well distributed throughout the Chamise Creek watershed and their distribution is generally limited only by natural channel conditions in the headwaters. Two passage impediments occur within the first mile above the confluence; the first is a boulder rough that is a partial barrier and the second is a waterfall that is passable during large winter flow events (CDFW PAD 2015).

History of Land Use

Like most Eel River tributaries, Chamise Creek was likely logged heavily during the early to mid-20th century. Other historical land uses may have included grazing and limited agricultural development. Currently, much of the lower watershed is privately owned, with some rural residential development occurring. The upper half of the watershed is a mix of private and Federally-owned (Bureau of Land Management, BLM) land. Chamise Creek is part of the larger Middle Eel River watershed, defined as the mainstem Eel River and associated tributaries between the South Fork Eel River confluence and the town of Dos Rios, California.

Current Resources and Land Management

Approximately 83 percent of the watershed is privately owned with the remainder managed by the BLM (16 percent) or the State of California (1 percent). No formal land management guidelines or rules currently govern activities or development within the Chamise Creek basin; the BLM land is managed by the Arcata Field Office under their Resource Management Plan.

Salmonid Viability and Watershed Conditions

The following habitat attributes were rated Poor through the CAP process: habitat complexity, water quality, riparian vegetation, viability, and sediment. Recovery strategies will typically focus on ameliorating these habitat attributes, although strategies that address other attributes may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Chamise Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Poor instream habitat complexity is suspected within the Chamise Creek watershed, based upon similar findings within adjacent Middle Eel River tributaries. Juvenile rearing success is likely compromised by poor instream shelter conditions and wood volume.

Hydrology: Baseflow and Passage Flows

The lower mainstem section of Chamise Creek suffers from low summer flow volume (Downie 2010), which likely limits juvenile steelhead rearing and survival within that section of the watershed. Although the causative factors are unclear at this time, the low-flow conditions may be a result of stream diversions and groundwater pumping by rural property owners, as well as high instream sediment volumes that force streamflows subsurface during summer months.

Sediment: Gravel Quality and Distribution of Spawning Gravels

High levels of instream fine sediment likely impair steelhead spawning and rearing success within Chamise Creek. The Middle Eel River watershed is considered impaired due to high instream sediment conditions (USEPA 2008), with past sediment loading within the system approximately 146% of the natural loading amount. The report does indicate that considerably less natural and human-related sediment was produced since the 1970s, perhaps due to improvements in land management or favorable winter storm patterns (*i.e.,* reduced frequency of large, erosion-causing rainfall events).

Water Quality: Temperature

Summer water temperatures are likely limiting juvenile steelhead survival within the Chamise Creek watershed. The Middle Eel River TMDL (USEPA 2008) modeled changes to instream water temperatures resulting from differing riparian vegetation conditions to answer whether or not current practices and conditions are altering natural stream temperatures. Modeling results suggest that stream temperatures within much of Chamise Creek would be slightly cooler under historical riparian conditions versus those that exist currently. Furthermore, the modeling estimates that only 27% of modeled stream reaches exhibit maximum temperatures below 19°C at current shading levels, whereas that number would improve to 37% under the historical (*i.e.*, more natural) shading regime.

Viability: Density, Abundance, and Spatial Structure

The viability of the Chamise Creek steelhead population is likely depressed from historical measures (F. Rogers, NMFS, personal communication, July 27, 2015). The cause of the suspected low juvenile abundance is difficult to pinpoint at this time, but may be related to high summer water temperatures, or poor egg to fry survival resulting from highly embedded spawning gravel.

Other Stresses

Improving canopy cover is a potential restoration action prescribed for many Middle Eel River tributaries (Becker and Reining 2009), and thus is a likely priority within Chamise Creek as well. The high density of riparian roads within the basin has likely impacted riparian function and structure by disrupting natural fluvial processes that create and maintain riparian habitat (*e.g.*, lateral channel migration, periodic floodplain inundation, *etc.*).

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Chamise Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Chamise Creek CAP Results.

Roads and Railroads

Overall road density within the Chamise Creek watershed is fairly low (1.6 road miles/square mile watershed area), with the highest road density found within the northwest section of the drainage. Of concern within the watershed is the high road density occurring within stream riparian corridors (1.3 mile/square mile). Riparian roads can more effectively deliver road sediment to the stream channel than upslope roads, and often confine the stream channel. As a result, riparian roads often preclude lateral channel migration, thus impairing natural fluvial and geomorphic processes responsible for creating and maintaining instream habitat features. Few road crossings completely block adult steelhead passage within the Chamise Creek watershed, although several do impede passage through the lower section of the mainstem creek at certain flow levels.

Residential and Commercial Development

Residential development, and its potential impact on instream flow and habitat quality, is a concern within the Chamise Creek watershed, given the suspected increase in subdivision activity and rural residential development within the basin (Downie 2010). Poorly planned and implemented residential development can increase hillside erosion, and reduce groundwater and instream flow levels.

Other Threats

No fish hatcheries operate within the Chamise Creek watershed, so hatchery-related effects are unlikely within the steelhead population. Similarly, invasive species are not known to be problematic within the basin, although pikeminnow inhabit portions of the Eel River and may reside within Chamise Creek, either permanently or seasonally. No dams or large water impoundments exist within the basin. The irrigation of illegal outdoor marijuana grows, using either surface flow or hydrologically connected groundwater, has likely impaired summer baseflow to some degree during the past several years (illegal marijuana cultivation has recently surged throughout much of the Eel River basin). Future residential development may also increase stream diversion and groundwater pumping within the watershed, and thus should be monitored carefully.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggest summer rearing habitat is likely a limiting factor affecting steelhead abundance within the Chamise Creek watershed. Long stretches of the lower watershed go dry during late summer months, and high summer water temperatures likely limit juvenile steelhead survival within most wetted reaches.

General Recovery Strategy

Assess and Address Upslope Sediment Sources
The Chamise Creek TMDL identifies high sediment loads as limiting aquatic habitat within the watershed. A road and watershed assessment should be conducted to identify sources of sediment, and high priority sites should be restored and rehabilitated.

Perform Intensive Habitat Survey
As noted earlier, very little information exists regarding aquatic habitat conditions within Chamise Creek. Prior to any restoration actions, an intensive habitat survey should be conducted. An investigation into the suspected poor summer flow volume should be included in any habitat survey, and potential solutions that conserve summer baseflows (*e.g.*, winter storage programs) should be investigated and implemented, where feasible.

Rehabilitate Riparian Function and Composition
The composition of the Chamise Creek riparian corridor has likely shifted away from natural conditions, which has lessened available canopy coverage of streams and increased solar warming of the aquatic environment (USEPA 2008). Restoration efforts should re-establish a natural, native riparian corridor in stream reaches where canopy values are sub-optimal.

Literature Cited

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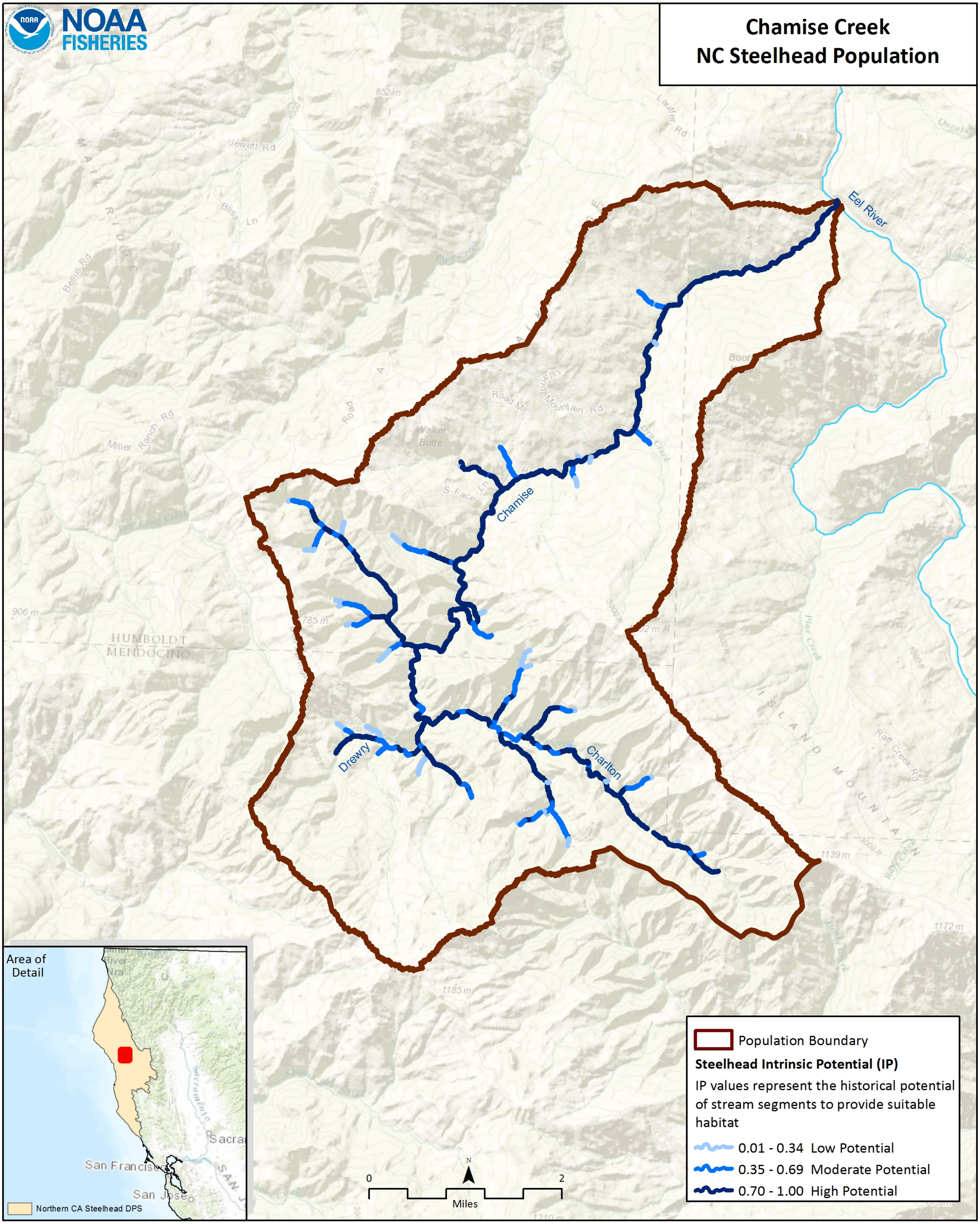

NOAA FISHERIES
Chamise Creek
NC Steelhead Population
Eel River
Chamise
Charlton
Drewry
HUMBOLDT
MENDOCINO
Area of Detail
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
2
Miles

NC Steelhead Chamise Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition		Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-km (>40% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	<50% of streams/ IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition		Properly Functioning Condition	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.05% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	1% of Watershed in Timber Harvest in last 15 years	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.6 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	1.3 Miles/Square Mile	Poor

NC Steelhead Chamise Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Medium	Low	Medium
2	Channel Modification	Medium	Low	Medium	Low	Medium	Low	Medium
3	Disease, Predation and Competition	Medium		Medium	Low	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	Low		Low		Low	Low	Low
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Low	Low	Low
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Medium	High	Medium	Low	Low	Medium
12	Roads and Railroads	Low	High	High	Medium	Medium	Medium	High
13	Severe Weather Patterns	Medium	Low	Medium	Medium	Medium	Low	Medium
14	Water Diversion and Impoundments	Medium	Low	High	Medium	Medium	Low	Medium

Chamise Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ChC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
ChC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
ChC-NCSW-3.1.1.1	Action Step	Hydrology	Provide incentives to water rights holders and water uses to improve flows by offering incentives, developing a forbearance program, or similar measures.	2	20	NMFS	
ChC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
ChC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches.	3	5	CDFW	
ChC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Utilize existing watershed analyses or habitat surveys, or conduct new analyses where needed, in order to prioritize restoration actions.	3	5	CDFW, NMFS	
ChC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Complete habitat surveys to document habitat quality and availability within the mainstem and tributaries.	2	10	CDFW, NMFS	
ChC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Conduct outreach with private landowners in order to complete habitat surveys and establish restoration priorities on private lands.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency				
ChC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris to maintain current stream complexity, pool frequency, and depth.	3	50	CalFire, CDFW, Private Landowners	
ChC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
ChC-NCSW-7.1.1.1	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other NC steelhead and CC Chinook salmon habitat needs.	3	25	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-7.1.1.2	Action Step	Riparian	A comprehensive evaluation and monitoring program should be implemented to determine areas where poor riparian habitat is producing water temperatures that limit juvenile steelhead survival.	1	10	CDFW, NMFS, Private Landowners	
ChC-NCSW-7.1.1.3	Action Step	Riparian	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
ChC-NCSW-7.1.1.4	Action Step	Riparian	Fence riparian areas within the watershed from grazing by using fencing standards that allow other wildlife to access the stream.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-7.1.1.5	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, ivy, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	2	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
ChC-NCSW-7.1.2.1	Action Step	Riparian	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-7.1.2.2	Action Step	Riparian	Manage riparian areas for their site potential composition and structure.	1	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-7.1.2.3	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
ChC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				

Chamise Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ChC-NCSW-8.1.1.1	Action Step	Sediment	Improve habitat conditions for multiple life stages by reducing sediment inputs to the stream at the watershed scale.	3	20	CalFire, CDFW, Private Landowners, RCD	
ChC-NCSW-8.1.1.2	Action Step	Sediment	Re-establish natural sediment delivery processes and implement sediment reduction activities where necessary.	3	20	CalFire, CDFW, Private Landowners, RCD	
ChC-NCSW-8.1.1.3	Action Step	Sediment	Provide incentives to restore high priority erosion sites as determined by watershed analysis, CDFW, or CalFire.	2	25	CDFW, Mendocino County, NMFS	
ChC-NCSW-8.1.1.4	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with NC steelhead and CC Chinook salmon recovery priorities.	2	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
ChC-NCSW-10.1.1.1	Action Step	Water Quality	Improve summer rearing survival by reducing instream temperatures in potential rearing reaches.	3	20	CDFW, NMFS, Private Landowners, RCD, RWQCB	
ChC-NCSW-10.1.1.2	Action Step	Water Quality	Monitor instream water temperatures to determine baseline conditions and judge the efficacy of restoration actions.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-10.1.1.3	Action Step	Water Quality	Determine site-specific recommendations, including incentives, to remedy high temperatures and implement accordingly (CDFG 2004).	1	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
ChC-NCSW-11.1.1.1	Action Step	Viability	Conduct a comprehensive assessment of watershed processes (e.g., hydrology, geology, fluvial-geomorphology, water quality, and vegetation), instream habitat, and factors limiting Chinook salmon and steelhead production.	2	5	CDFW, NMFS, Private Landowners	
ChC-NCSW-11.1.1.2	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	3	20	CDFW, NMFS	
ChC-NCSW-11.1.1.3	Action Step	Viability	Utilize CDFW approved implementation, effectiveness, and validation monitoring protocols when assessing efficacy of restoration efforts.	2	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
ChC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
ChC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
ChC-NCSW-22.1	**Objective**	**Residential/ Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure				
ChC-NCSW-22.1.1.1	Action Step	Residential/ Commercial Development	Promote re-vegetation of native riparian plant communities within inset floodplains and riparian corridors to ameliorate high instream water temperatures and provide a source of future large woody debris recruitment.	2	100	CDFW, NMFS, Private Landowners	
ChC-NCSW-22.1.1.2	Action Step	Residential/ Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams and to provide shade.	3	50	CDFW, NMFS, Private Landowners	
ChC-NCSW-22.1.1.3	Action Step	Residential/ Commercial Development	Work with agencies to minimize development or disturbance within riparian zones and the 100-year flood prone zones.	2	100	NMFS, Mendocino County, Private Landowners	
ChC-NCSW-22.2	**Objective**	**Residential/ Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**				
ChC-NCSW-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				

Chamise Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ChC-NCSW-22.2.1.1	Action Step	Residential/ Commercial Development	Improve education and awareness of agencies, landowners and the public regarding salmonid protection and habitat requirements.	3	20	NMFS, CDFW	
ChC-NCSW-22.2.1.2	Action Step	Residential/ Commercial Development	Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.	2	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
ChC-NCSW-22.2.2.1	Action Step	Residential/ Commercial Development	Minimize the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	2	100	Mendocino County, Private Landowners	
ChC-NCSW-22.2.2.2	Action Step	Residential/ Commercial Development	Identify areas at increased risk of mass wasting and elevated fine sediment load, and decrease sediment from transportation projects and land management activities in those areas (CDFG 2004).	2	10	CDFW, NMFS, Private Landowners	
ChC-NCSW-22.2.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to riparian species composition and structure				
ChC-NCSW-22.2.3.1	Action Step	Residential/ Commercial Development	Develop policy and guidelines that address land conversion and attempt to minimize conversion-related impacts within the aquatic environment.	3	10	CDFW, Mendocino County, NMFS	
ChC-NCSW-22.2.3.2	Action Step	Residential/ Commercial Development	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses.	2	10	CDFW, Mendocino County, NMFS	
ChC-NCSW-22.2.3.3	Action Step	Residential/ Commercial Development	Purchase conservation easements from landowners that currently have timber, grazing or agricultural operations within the watershed.	2	25	CDFW, NMFS, NRCS, Private Landowners, RCD	
ChC-NCSW-22.2.3.4	Action Step	Residential/ Commercial Development	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	2	5	CDFW, Mendocino County, NMFS	
ChC-NCSW-22.2.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance				
ChC-NCSW-22.2.4.1	Action Step	Residential/ Commercial Development	Minimize degradation of steelhead and Chinook salmon habitat through proper land-use zoning.	3	25	CalFire, CDFW, Mendocino County, NMFS	
ChC-NCSW-22.2.4.2	Action Step	Residential/ Commercial Development	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., frequent flooding, extreme low flow conditions (drought), sea level rise, etc.).	3	50	CalFire, Mendocino County, NMFS	
ChC-NCSW-22.2.4.3	Action Step	Residential/ Commercial Development	Encourage Mendocino County to permit new developments that avoid unstable slopes, wetlands, areas of high habitat value, consider water supply and similarly constrained sites that occur adjacent to Chinook salmon and steelhead habitat.	2	10	Mendocino County, NMFS, CDFW	
ChC-NCSW-22.2.4.4	Action Step	Residential/ Commercial Development	Encourage Mendocino County to develop and implement ordinances (e.g., Santa Cruz) to restrict subdivisions by requiring a minimum acreage limit for parcelization and in concert with limits on water supply and groundwater recharge areas.	2	10	CDFW, Mendocino County, NMFS	
ChC-NCSW-22.2.4.5	Action Step	Residential/ Commercial Development	Work with Mendocino County to develop more protective regulations in regard to development (vineyard, other agriculture and rural residential).	3	10	CDFW, Mendocino County, NMFS	
ChC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ChC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
ChC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	20	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners	
ChC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement riparian road upgrades on high priority roads.	2	25	CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners	
ChC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Work with the County of Mendocino DOT to upgrade existing high priority riparian road segments identified by the county or resource agencies.	2	10	County of Mendocino, CDFW, NMFS	

Chamise Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ChC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority riparian roads, or those identified in a sediment reduction plan.	2	10	CDFW, NMFS, Private Landowners	

Outlet Creek Population

NC Steelhead Winter-Run

- Role within DPS or ESU: Potentially Independent Population
- Diversity Stratum: Lower Interior
- Spawner Abundance Target: 3,800 adults
- Current Intrinsic Potential: 188.7 IP-km

For information regarding CC Chinook salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan.

Abundance and Distribution

The estimated historical population abundance of adult steelhead in Outlet Creek is approximately 2,300 spawners (Spence *et al.* 2012), whereas the current estimate made by fishery biologists working in this watershed is approximately 1,200 spawners (LeDoux-Bloom and Downie 2008).

CDFW has conducted juvenile steelhead distribution surveys for over 30 years in Outlet Creek that show most (88 percent) of the larger tributaries are inhabited by steelhead trout. When current steelhead distribution is compared to the potential historic habitat suggested by Spence *et al.*, (2012) the current distribution is less than 50 percent of the historic habitat that could been utilized by steelhead.

Areas of high quality habitat in this basin exist within Ryan Creek, Long Valley Creek, and Cherry Creek. Medium quality habitat exists in reaches of Outlet, Willits, Broaddus, and Baechtel creeks (LeDoux-Bloom and Downie 2008).

History of Land Use

The first European settlers arrived in the Outlet Creek watershed in the early 1840s where five Pomo Villages already existed. Pomos were known to manage the land with the use of fire to clear brush and vegetation in order to improve forage for deer and increase acorn yields. The first white settlers of the area were cattle ranchers, such as A.E. Sherwood and the Baechtels who drove cattle to the Willits Valley in the 1850s. Timber harvest began shortly after, when there were efforts to convert conifer forests to grazing land. The Northwest Railroad reached Willits in 1901, and the Skunk Line began operation in 1911. These rail lines were utilized to transport lumber to the bay area until the 1930s when large commercial timber operations decreased due to the great depression.

In the northern area of the Willits Valley a lake forms, creating a seasonal lake. The lake continues to form today, but is reduced in size due to agricultural activities first conducted around 1910 that drained and diked much of the lake bed. Over time streams were dredged and moved to accommodate the railroad, grazing, and potato farming (CDWR 1965). By the end of the 1930s, most of the larger streams, such as Baechtel, Broaddus, Berry, and Davis creeks, had been channelized and levied for agriculture and transportation (LeDoux-Bloom and Downie, 2008).

An additional wave of timber harvesting occurred during the post-World War II era. Tractor logging methods during this era harvested the remaining old growth fir in the basin and left the landscape susceptible to erosion from the 1955 and 1964 winter storms. With the implementation of the Zberg-Nedjly Forest Practice Act in 1973, timber harvest practices improved, but low tree retention standards along riparian areas further degraded riparian habitat in the watershed.

Six dams have been constructed for water supply and recreation in the watershed. The City of Willits operates two of these dams, which are located on Davis Creek. Morris Dam (constructed in 1924) and Centennial Dam (1989) store a combined total of 1,359 acre-feet (LeDoux-Bloon and Downie, 2008). The Brooktrails Township Community Service also operates two dams, Lake Emily on Willits Creek and Lake Ada Rose, which is an off-channel reservoir. Lake Emily stores approximately 275 acre-feet and Lake Ada Rose stores 138 acre-feet. The largest impoundment is operated by the Boy Scouts of America, a reservoir impounding 800 acre-feet of water located on a tributary to Berry Creek. The smallest reservoir holds 45 acre-feet of water and is operated by Pine Mountain Mutual Water Company.

In the last 10 years there has been a dramatic increase in medical and commercial production of cannabis in the watershed. LeDoux-Bloom and Downie (2008) report juvenile salmonid stranding in some stream reaches due to stream diversions from the large number of grow operations. Other current land uses include some timber operations which provide limited employment, along with ranching and tourism. The largest town within the watershed is Willits, which acts as a bedroom community to Ukiah. The Willits Bypass project is under construction which will bypass Willits on the east side in order to minimize traffic congestion.

Current Resources and Land Management

The Outlet Creek watershed encompasses an area of 162 square miles and is predominantly in private ownership (91 percent) with grazing, timber, and rural residential as the major land uses. Public land makes up just 8 percent of the basin, with most existing in scattered BLM ownership. The human population in the watershed currently has only 12,580 people, the majority living in the City of Willits and the residential area of Brooktrails. The Willits Environmental Center and the Willits Watershed Group are the most active environmental groups in the watershed. These groups focus on environmental protection and watershed restoration in in Outlet Creek and its tributaries.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, riparian tree diameter, and shelter rating, for all lifestages. Additional habitat indicators that were rated as Poor for juveniles were summer baseflow, primary pools, instantaneous flow condition, passage migration, physical barriers and stream temperature. Also, floodplain connectivity was rated Poor for juvenile winter rearing. Gravel embeddedness was also unsuitable for the egg lifestage for most streams in the watershed. The only indicator related to watershed processes that was rated as Poor was road density in riparian areas.

Recovery strategies will typically focus on improving these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that rated as Fair through the CAP process, include gravel quality for eggs, and urbanization with respect to watershed processes.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Outlet Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Juvenile and adult salmonids require instream shelter for protection from predators, habitat partitioning from other fish, and providing areas of reduced velocity for energy conservation. CDFW habitat inventories indicate shelter ratings throughout the Outlet Creek watershed are poor, with 8 of 9 sampled reaches rated as Poor. Poor to fair LWD volume was also documented within these drainages, due largely to a lack of functional riparian habitat and limited recruitment of large conifer and hardwoods species from adjacent upslope areas. Poor shelter ratings across the basin reduce habitat quality for all salmonid life stages.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The abundance of primary pools is poor in most tributary streams, but is good in Outlet Creek. Most sampled streams have a high percentage of flatwater or run habitat that is lower quality for salmonids due to the general lack of depth, complexity and velocity refuge. Low pool abundance in this basin reduces the space available for juvenile fish attempting to maintain territory for feeding and protection from predators, and likely stems from increased sediment production (pool filling) and reduced LWD recruitment caused by past land use practices. Therefore, we rated the conditions for this habitat attribute as Poor for both winter and summer rearing juvenile steelhead.

Hydrology: Baseflow and Passage Flows

Six dams and an unknown number of stream diversions impact summer baseflow conditions, impairing juvenile steelhead rearing throughout much of the Outlet Creek watershed. The cumulative effect from reduced summer baseflow below Centennial, Morris, and the Boy Scout reservoirs reduces summer flow to Outlet Creek.

The other large contributor to low summer baseflow is the dramatic increase in instream diversions from cannabis production and associated rural residential development, which has resulted in reduced summer flow and dry reaches in many streams (LeDoux-Bloom and Downie 2008).

Passage/Migration: Mouth or Confluence and Physical Barriers

Stream diversions, poor reservoir management and road crossings impair passage conditions for juvenile steelhead. Impaired passage conditions likely lower steelhead survival by reducing the potential for juveniles to find suitable stream temperatures or more favorable habitats during the summer low flow period. There are also a number of passage barriers that impede upstream migration for adult steelhead (S. Harris, CDFG, personal communication, 2010). Improving passage conditions at culverts and road crossings on streams such as Ryan and Long Valley will improve adult migration into upstream spawning areas. Also, passage impediments need to be improved at two railroad crossings that exist on Haehl Creek.

Velocity Refuge: Floodplain Connectivity

Streams in the Outlet Creek watershed that should have functional floodplains include low gradient reaches of Outlet, Mill, Broaddus, Haehl, Davis and Baechtel creeks. These stream reaches are associated with the low gradient areas of the Little Lake Valley, which forms a lake on the northern end during the winter and spring. Historical agricultural activities have reduced floodplain connectivity by channelizing or relocating channels to facilitate land use on the valley floor. Losing floodplain connectivity limits low-velocity refuge habitat availability during the winter and spring months for juvenile salmon and steelhead.

Water Quality: Temperature

Summer water temperatures are unsuitable throughout many stream reaches across this watershed. A few areas exhibiting cool water temperatures include tributaries such as Ryan Creek, Willits Creek, and Bloody Run Creek, which still retain relatively good native hardwood and conifer riparian corridors. Most of the streams in the southern part of the watershed, such as the Outlet, Davis, Baechtel, and Broaddus creeks, currently have poor riparian habitat and marginal to unsuitable stream temperatures.

Other Current Conditions

Spawning habitat quality is poor in parts of the basin due to road-related sediment delivery, but was not rated overall as a Poor condition. The impact from cannabis production is also an ongoing water quality concern. Mixing of fertilizers directly in streams that flow into salmonid habitat is a common practice that has been observed at many areas across Mendocino County.

Threats

The following discussion focuses on those threats that are rated as High or Very High (see Outlet Creek CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Outlet Creek CAP Results.

Water Diversion and Impoundments

Threats from water diversions and impoundments in the Outlet Creek come from three moderately sized reservoirs, diversions associated with cannabis production and rural residential development. Morris and Centennial dams operated by the City of Willits do not adhere to streamflow bypass requirements by CDFW, and as a result summer flow is low or intermittent downstream of these facilities. The largest impoundment, the Boy Scout Dam (800 acre-feet), does not release adequate bypass flows, which will continue to impair summer flow for juvenile steelhead in Berry Creek and Outlet Creek. Lake Emily and Ada Rose are operated by the Brooktrails Township Community Services District (BTCSD). The BTCSD minimizes flow impacts by adhering to a release schedule that is set by CDFW. The larger reservoir, Lake Emily, is required to bypass flow for adult salmon and steelhead, and maintain natural flow releases downstream based on accurate and verifiable releases from a USGS gauging station that measures inflow to the reservoir.

Cannabis production is a serious and growing threat in this watershed. LeDoux-Bloom and Downie (2008) documented that diversion from large grows resulted in dry channels, stranded or dead juvenile salmonids, and reduced migration opportunities due to these impacts. These large grows can require large stream diversions to supply plants during the summer growing season. This threat is likely to continue and become an increased source of stress on baseflow and water quality conditions for juvenile salmonids.

Other Threats

Other threats in the Outlet Creek basin that continue to stress salmonid habitat include roads, grazing, rural residential development, and timber harvesting. Erosion from poorly built and maintained riparian roads continues impact habitat suitability by delivering fine sediment to spawning and rearing reaches. Ongoing timber harvest and livestock grazing continue to degrade stream reaches through associated roads and riparian impacts. Rural residential development could become a High threat in the future; LeDoux-Bloom and Downie (2008) describe the large increase in human population across the watershed due to cannabis production. We attempt to capture this threat in the water diversion section above, but other impacts from rural residential development, such as land clearing and road building are likely to increase in the future.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggest juvenile habitat quality is likely limiting steelhead recovery in the Outlet Creek watershed. Low summer baseflows limit rearing habitat availability across the basin. Other habitat conditions that also limit juvenile salmonid production include poor floodplain connectivity and inadequate stream shelter and pool habitat. Although shade canopy is rated as Fair for surveyed reaches in the watershed, stream temperatures across much of the basin contribute to reduced juvenile habitat suitability. In addition there are tributaries that continue to be affected by high sediment yields that fill pools and reduce spawning habitat quality.

General Recovery Strategy

Minimum bypass flow requirements at Centennial, Morris, and Boy Scout reservoirs need to be implemented to improve summer habitat conditions below these facilities. Address water diversion and groundwater extraction causing reduced and disconnected flow conditions throughout the basin. Federal, state and local government representatives or community groups should work with landowners to implement creative solutions that minimize these effects. Solutions should examine conservation methods, water management planning, and water storage and recharge. In addition, improved coordination between NMFS, CDFW, county law enforcement agencies, and landowners must be implemented to reduce the number of illegal stream diversions within this basin.

Improve Canopy Cover and LWD Volume

Much of the Outlet Creek watershed would benefit from improved riparian composition and structure, which would increase stream shading, improve LWD recruitment, and increase instream shelter. General practices to improve riparian condition include improving riparian areas protection (*e.g.*, increasing the number of riparian conservation easements), reducing development in riparian areas, and implementing riparian planting and livestock exclusion fencing.

Address Riparian Road Sediment Sources

Riparian roads associated with various land uses exist throughout the basin. Many of these roads need to be upgraded to reduce fine sediment delivery into streams. Problem roads and active erosion sites should be prioritized and addressed as part of a comprehensive sediment reduction plan at the subbasin level. Rural residential development and associated grading activities must be closely monitored and controlled by the County of Mendocino, or state agencies to minimize soil disturbance and sediment delivery to stream channels.

Increase Instream Shelter Ratings and Pool Volume

Shelter ratings are Low within many (90 percent) of the surveyed stream reaches of the Outlet Creek watershed. Where applicable, restoration efforts should incorporate instream wood/boulder structures and/or large conifers (*i.e.*, fall trees) into degraded reaches to improve shelter and overall habitat complexity. Also, floodplain connectivity should be improved in low gradient stream reaches occurring in the Willits Valley and Outlet Creek.

Improve Passage at Migration Barriers

Addressing migration barriers caused by road and railroad crossings would improve habitat utilization for both spawning adults and rearing juveniles. There should be further assessments of a number of existing natural barriers, such as Cherry Creek, to determine the potential to provide passage above these barriers for additional habitat utilization by steelhead. Also, studies should be initiated to evaluate the potential for passage and rearing above the larger reservoirs.

Literature Cited

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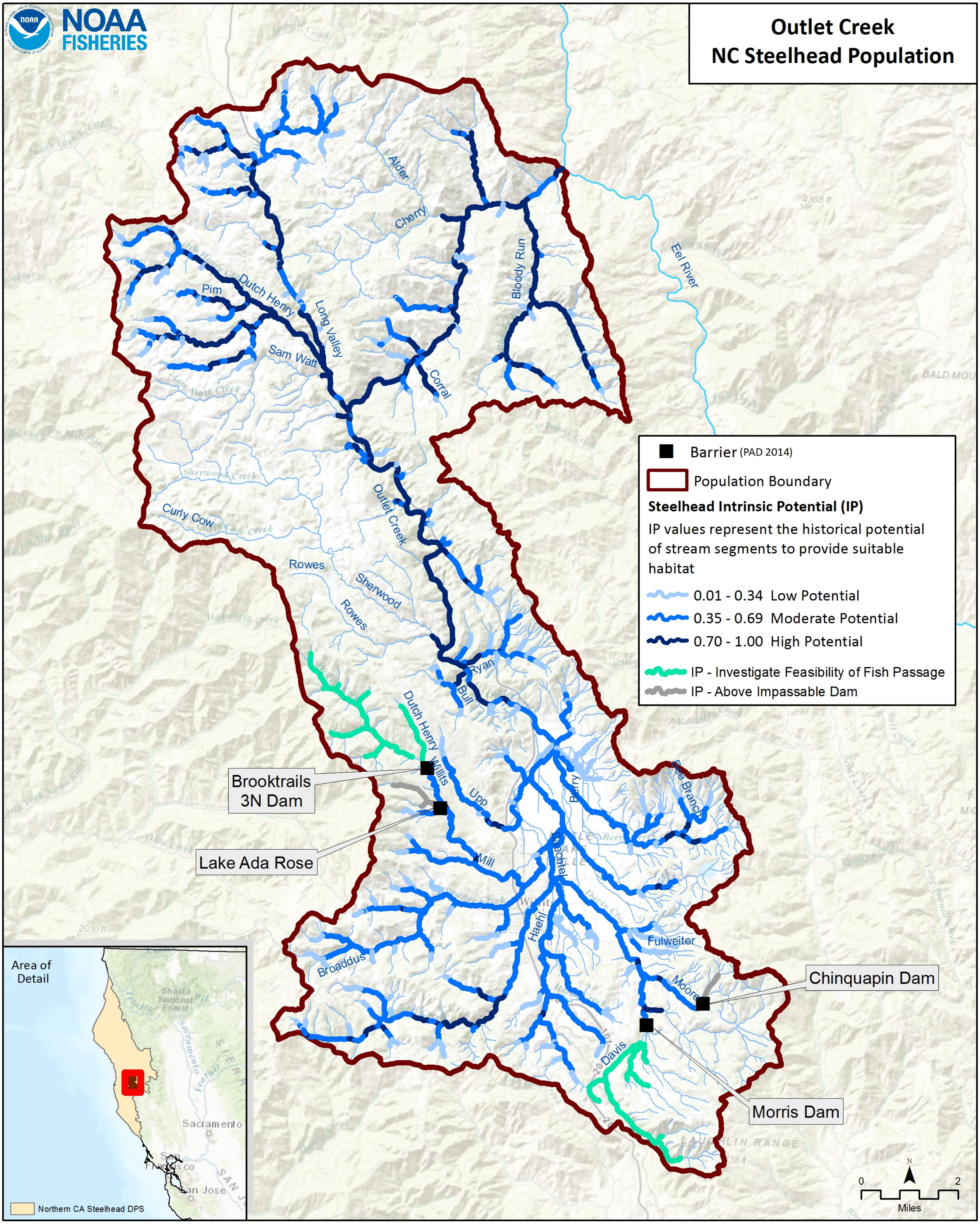
Spence, B. C., E. P. Bjorkstedt, S. Paddock, and L. Nanus. 2012. Updates to biological viability criteria for threatened steelhead populations in the North-Central California Coast Recovery Domain. National Marine Fisheries Service, Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, CA.


NOAA FISHERIES
Outlet Creek
NC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Investigate Feasibility of Fish Passage
IP - Above Impassable Dam
Brooktrails 3N Dam
Lake Ada Rose
Chinquapin Dam
Morris Dam
Eel River
Alder
Cherry
Bloody Run
Pim
Dutch Henry
Long Valley
Sam Watt
Corral
Outlet Creek
Curly Cow
Rowes
Sherwood
Ryan
Bull
Willits
Upp
Mill
Berry
Bechtel
Haehl
Broaddus
Fulweiter
Moore
Davis
Area of Detail
Sacramento
Northern CA Steelhead DPS
0 2
Miles

NC Steelhead Outlet Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	≤39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP-km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	≤39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	?39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	20-30% of Watershed in Agriculture	Fair
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	Fair
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.5 to 3 Miles/Square Mile	Fair
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	>1 Miles/Square Mile	Poor

NC Steelhead Outlet Creek CAP Viability Results

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific-threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Medium	Medium
2	Channel Modification	Low	Low	Medium	High	Low	Low	Medium
3	Disease, Predation and Competition							
4	Fire, Fuel Management and Fire Suppression		Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Low		Low				Low
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Medium	Low	Medium	Medium
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Low	Medium	Medium
9	Mining	Low	Low					Low
10	Recreational Areas and Activities							
11	Residential and Commercial Development	Low	Low	Medium	Medium	Low	Medium	Medium
12	Roads and Railroads	Low	Medium	Medium	Medium	Low	Medium	Medium
13	Severe Weather Patterns	Low	Low	High	Medium	Low	Medium	Medium
14	Water Diversion and Impoundments	Medium	Medium	Very High	High	Medium	High	High

Outlet Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
OC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Increase the frequency and functionality of floodplain habitats to improve over-winter survival.	2	10	CDFW, NMFS, RCD	
OC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, removal of levees, and use streamway concept where appropriate.	2	20	CDFW, NMFS, RCD	
OC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Work with landowners in the Willits Valley to restore floodplain connectivity within stream reaches of Outlet Creek, Davis Creek, lower Baechtel Creek and Haehl Creek are high priority for these actions.	1	20	Mendocino County RCD, NRCS, Private Landowners	
OC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
OC-NCSW-3.1.1.1	Action Step	Hydrology	Improve bypass flows from existing reservoirs to maintain migratory passage for adult and juvenile steelhead, and to maintain suitable water quality during the summer.	1	10	CDFW, City of Willits, NMFS	
OC-NCSW-3.1.1.2	Action Step	Hydrology	Work with the City of Willits and the Boy Scouts of America to provide adequate bypass flow from Morris, and Centennial reservoirs, and the Boy Scout reservoir.	1	10	CDFW, City of Willits, NMFS	
OC-NCSW-3.1.2	Recovery Action	Hydrology	Improve flow conditions (baseflow condition)				
OC-NCSW-3.1.2.1	Action Step	Hydrology	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies are required to remove illegal diversions from streams across the Outlet Creek watershed.	1	25	CDFW, COMMET, NMFS, SWRCB	
OC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
OC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW and identified in the Passage Assessment Database (PAD).	1	10		
OC-NCSW-5.1.1.2	Action Step	Passage	Develop and implement fish passage projects based on priority from list developed by CDFW.	1	10	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.3	Action Step	Passage	Evaluate the potential for adult passage natural barriers within the Outlet Creek basin. Streams such as Cherry Creek and Sherwood Creek are a high priority for evaluation and potential projects.	1	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.4	Action Step	Passage	Evaluate and prescribe appropriate volitional and/or non-volitional passage methodologies for the following long standing dams in the Outlet Creek watershed. Lake Emily PAD 718927 on Willits Creek, Centennial Dam PAD 719282, and Morris Dam PAD 718926 on Davis Creek.	2	25	CDFW, COMMET, NMFS, SWRCB	
OC-NCSW-5.1.1.5	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Moss Cove Creek Passage ID 707088.	1	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.6	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at unnamed tributary to Haehl Creek Passage ID 712894.	1	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.7	Action Step	Passage	Evaluate, design, and implement appropriate fish passage on Long Valley Creek at Highway 101 at three sites (Passage ID 707090, 707091, and 707094).	1	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.8	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at the culvert on an unnamed tributary Passage ID 730536.	2	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.9	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at south and north fork of Fulweiter Creek on Eastside Road Passage ID 735068, and 705898).	1	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.10	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Moore Creek Passage ID 707894).	1	5	CDFW, NMFS, Private Landowners	
OC-NCSW-5.1.1.11	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at a tributary to Davis Creek on Eastside Road Passage ID 705897.	1	5	CDFW, NMFS, Private Landowners	

Outlet Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OC-NCSW-5.1.1.12	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at an unnamed tributary to Outlet Creek Passage ID 713155.	2	5	CDFW, NMFS, Private Landowners	
OC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
OC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Improve frequency of large woody debris, root wads, and boulders to improve habitat complexity, and pools. Focus efforts in Baechtel, Broaddus, Bloody Run, Cherry, Davis, Long Valley, Ryan creeks.	2	15	CDFW, NMFS, NRCS, Private Landowners	
OC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement a large woody debris supplementation program to increase stream complexity and gravel retention, and improve pool frequency and depth.	2	10	CDFW, NMFS, NRCS, Private Landowners	
OC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	25	CDFW, NMFS, NRCS, Private Landowners	
OC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
OC-NCSW-7.1.1.1	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization.	2	20	CDFW, Mendocino County RCD, NMFS, Private Landowners	
OC-NCSW-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	3	20	CDFW, Mendocino County RCD, NMFS, Private Landowners	
OC-NCSW-7.1.1.3	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	2	30	CDFW, Mendocino County RCD, NMFS, Private Landowners	
OC-NCSW-7.1.1.4	Action Step	Riparian	Prioritize and fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream). Focus efforts on stream reaches within Baechtel Creek, Broaddus Creek, Davis Creek, Haehl Creek, and Long Valley Creek.	2	10	CDFW, Mendocino County RCD, NRCS, Private Landowners	
OC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**				
OC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
OC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Work with CalFire to develop a fuels reduction plan for the Outlet Creek watershed that reduces impacts to listed salmonids and reduces potential for large stand replacing fires.	2	20	BLM, NMFS, USFS, CalFire	
OC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Work with CalFire and private landowners to improve coordination and planning of fuels reductions projects to avoid adverse impacts to riparian or in stream habitats in rural residential areas of the Outlet Creek watershed.	3	20	BLM, NMFS, USFS, CalFire	
OC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
OC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
OC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
OC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
OC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners	
OC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement riparian road upgrades identified in the Sediment Reduction Plan at high priority sites. High priority sites include unpaved roads in Ryan, Bull, Outlet creeks and possibly along reaches of upper Cherry Creek, Broaddus Creek, and Alder Creek.	2	10	CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners	
OC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Work with the County of Mendocino DOT to upgrade existing high priority riparian road segments identified in the Sediment Reduction Plan.	2	10	CDFW, County of Mendocino, NMFS	
OC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority riparian roads, or those identified in the Sediment Reduction Plan.	2	10	CDFW, NMFS, Private Landowners	

Outlet Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
OC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
OC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
OC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Work with agencies and water users to maintain existing instream salmonid habitat by minimizing water use and diversion during drought periods.	3	25	County of Mendocino, NOAA RC, Private Landowners	
OC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Work with rural residential water users within the Covelo area to implement water conservation, reclamation and water reuse measures.	2	20	County of Mendocino, NOAA RC, Private Landowners	
OC-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	2	20	County of Mendocino, NMFS, NOAA RC, Private Landowners	
OC-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
OC-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
OC-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	2	25	NMFS, CDFW, Private Landowners, RCD	
OC-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Develop off channel water storage for grazing, cannabis, and rural residential users within the watershed to increase summer surface flow across the watershed.	1	20	CDFW, Private Landowners	
OC-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
OC-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
OC-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Restore surface flows during the summer period to improve survival of the summer rearing life stage.	2	25	NCRWQCB, CDFW, NMFS, SWRCB	
OC-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies are required to remove illegal diversions from streams across the watershed.	1	20	CDFW, COMMET, NMFS, SWRCB	
OC-NCSW-25.2.1.3	Action Step	Water Diversion /Impoundment	Work with the City of Willits and the Boy Scouts of America to provide adequate bypass flow from Morris, and Centennial reservoirs, and the Boy Scout reservoir. Adequate bypass flows will maintain migratory passage for adult and juvenile steelhead, and maintain good summer water quality.	1	20	CDFW, City of Willits, NMFS	
OC-NCSW-25.2.1.4	Action Step	Water Diversion /Impoundment	Coordinate with County of Mendocino Marijuana Eradication Team to develop enforcement actions associated with illegal water diversions in the Outlet Creek watershed.	2	10	CDFW, COMMET, NMFS OLE	

Tomki Creek Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Lower Interior
- Spawner Abundance Target: 2,700 adults
- Current Intrinsic Potential: 89.5 IP-km

For information regarding CC Chinook salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan.

Abundance and Distribution

In 1965, the California Department of Water Resources (CDWR) estimated the run size of adult steelhead in Tomki Creek was approximately 3,000 to 4,000 spawners (CDWR 1965). Spence *et al.* (2012) estimates the historic number of adult spawners to be 2,700 fish based on historic habitat capacity in the Tomki Creek watershed.

Juvenile steelhead distribution information collected by CDFW during habitat typing surveys in the 1990s shows juvenile steelhead presence in most tributaries. There is a notable absence of juvenile steelhead rearing in the lower reaches of Tomki Creek, which have elevated stream temperatures. When current steelhead distribution is compared to the potential historic habitat (Spence *et al.* 2012), juvenile presence is found in approximately 50 to 75 percent of the potential historic steelhead habitat.. No current abundance estimates are available for adult or steelhead smolts for this watershed.

Areas of high quality habitat exist in String Creek, reaches of Little Cave Creek, and Wheelbarrow Creek. Medium quality habitat exists in stream reaches of Cave, Longbranch, and upper Tomki creeks (S. Harris, CDFG, personal communication, 2011).

History of Land Use

The first extensive land use occurred in the Tomki Creek watershed in the late 1930s with logging operations removing most of the merchantable timber by the early 1950s (MCRCD 1983). Most landowners cut timber at a short rotation, usually less than a 40 year rotation to maintain a tax exempt status with Mendocino County. Landowners also conducted extensive burning across the watershed to increase grazing acreage. Grazing since the late 1800s has occurred in the watershed, but little documentation of stocking numbers or accounts of overgrazing is available (MCRCD 1983).

Gravel extraction in Tomki Creek was conducted in the mid-1960s to supply material for road construction in the Willits subdivision of Brooktrails (R. Estabrook, personal communication, 2011). Approximately two miles of salmonid spawning area was mined in Tomki Creek to supply material for nearly 35 miles of road construction in the Brooktrails subdivision (MCRCD 1983).

In 1983, a pilot project in the Tomki Creek watershed was funded from Clean Water Act section 208 grant funding. The erosion and sediment control plan was developed to treat erosion sources in the watershed from past logging, grazing and road building. This pilot study reported that subbasins such as Cave, Wheelbarrow, and String creeks had high amounts of road related erosion. Many of the roads in these subbasins are within riparian areas and are responsible for gully formation and other road related erosion (MCRCD 1983). Since the mid-1980's, the Mendocino Resource Conservation District (RCD) has administered over $650,000 in grants to address high priority erosion sites in the watershed's 20 subbasins.

Over the last 40 years land parcel size has decreased with parcel splits that have increased rural residential development. Associated roads and water diversions have increased with the increase in rural development. Over the last 10 years, Mendocino County has experienced a dramatic increase in population due to cannabis production, with watersheds such as Tomki Creek, a prime location for large production sites requiring water diversions for plantations and associated residences (P. Steiner, SEC, personal communication, 2011).

Current Resources and Land Management

The Tomki Creek watershed encompasses an area of 40 square miles, and is predominately in private ownership (90 percent) with cannabis production, grazing, timber, and rural residential as the major land uses. Private ownership parcels within the watershed are varied, ranging from less than 10 acres to more than 5,000 acres. Public land makes up just 10 percent (4,020 acres) of the basin with most existing in scattered BLM ownership (MCRCD 1983).

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, riparian tree diameter, and shelter rating, primary pool frequency, and pool riffle ratio for all lifestages. Habitat indicators that were rated as Poor for juvenile steelhead were summer baseflow, riparian canopy cover, toxicity, and stream temperature. The indicators for watershed processes that were rated as Poor through the CAP analysis included road density within riparian areas, and land disturbance from urbanization (rural residential).

Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that rated as Fair through the CAP process, but are considered important within specific areas of the watershed include gravel quality for eggs, and riparian species composition with respect to watershed condition.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Tomki River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Instream shelter is required by juvenile salmonids as well as adult spawners for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. CDFW habitat inventories indicate shelter ratings throughout the Tomki Creek watershed are Poor, with only 40 percent of the potential habitat meeting suitability targets for shelter. Poor to Fair LWD instream volume was also documented within these drainages, due largely to poor recruitment of large conifer and hardwoods species from adjacent upslope areas.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Primary pool habitat is lacking in most tributary streams habitat typed by CDFW in the late 1990s. Habitat Complexity, percent primary pools and pool/riffle/flatwater ratios have an overall rating of Poor for both winter and summer rearing habitat. Most sampled streams have a high percentage of flatwater or run habitat that is generally less suitable for rearing lifestages of salmonids due to lack of depth, complexity and velocity refuge. The lack of pools in this basin likely limits the space available for juvenile fish attempting to maintain residency over the summer low flow period. Lack of pool habitats within this basin likely stems from high instream sediment concentrations (pool filling), low LWD recruitment, and stream diversion.

Hydrology: Baseflow and Passage Flows

Summer baseflow is expected to be reduced compared to coastal areas due to the warmer, drier interior physical setting of Tomki Creek. When surface diversions further depress naturally low water levels, streamflow can be a critical factor affecting steelhead survival during the summer. Currently, stream reaches in the southern portion of the watershed are likely experiencing the highest level of impact from diversion activities.

Water Quality: Temperature

High summer water temperatures are reducing steelhead habitat quality throughout many sections of the Tomki Creek watershed. The few areas noted as exhibiting cool water temperatures include three tributaries to Cave Creek, Scott Creek, and an unnamed tributary to Longbranch Creek that still retain relatively good native hardwood and conifer riparian corridors. Most of the streams in the watershed, such as the Tomki, Salmon, Cave, Longbranch, and Wheelbarrow creeks currently have less than suitable stream temperatures.

Other Current Conditions

Sediment Transport from roads conditions has a rating of Fair for the egg lifestage. Also, impacts from poaching on adult salmon and steelhead abundance have been an issue in this watershed. Poaching of spawning steelhead and salmon has persisted over many decades due to the isolated nature of the basin.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Tomki Creek CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address medium and low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Tomki Creek CAP Results.

Water Diversion and Impoundments

Cannabis production is a serious and growing threat in this watershed. Water diversion by large cannabis cultivators and associated rural residential water use impacts summer baseflow. We base this conclusion on information from nearby basins such as Outlet Creek (LeDoux-Bloom and Downie 2008), and personal communications with biologists conducting field surveys in the Tomki Creek watershed (P. Steiner, SEC, personal communication, 2011). Cannabis grow operations require large water diversions to supply plants during summer and fall growing season. This activity is an ongoing impact on summer baseflow conditions for juvenile salmonids. Subbasins that appear to be most impacted by this activity include the Cave, Scott, Salmon, and Longbranch areas in the southern portion of the watershed.

Other Threats

Threats in the Tomki Creek basin that continue to stress salmonid habitat include roads, livestock grazing, rural residential development, and timber harvesting. Riparian road densities associated with rural-residential development continue to reduce salmonid habitat suitability by delivering fine sediment to spawning and rearing reaches. Rural residential development will likely become a high threat in the future. We attempt to capture this threat in the water diversion section above, but other impacts from rural residential development, such as land clearing, water use, and road building, are an ongoing issue.

Limiting Stresses, Lifestages, and Habitats

Reduced summer streamflows limit rearing habitat availability in many stream reaches across the basin. Other habitat conditions that also limit juvenile salmonids include poor stream shelter, pool habitat, and LWD-related structure or other roughness elements that form pools. Also, shade canopies and stream temperatures were rated as Poor for surveyed reaches in the watershed.

General Recovery Strategy

Address Water Diversion and Groundwater Extraction

To address reduced and disconnected flow conditions (*e.g.*, dry stream channels) resulting from water diversions and groundwater pumping, Federal, state, local government, or community based representatives should work with landowners to implement creative solutions that minimize these effects. In addition, improved coordination between NMFS, CDFW and county law enforcement agencies must occur to reduce the number of illegal stream diversions within this basin.

Improve Canopy Cover and LWD Volume

Much of the Tomki Creek watershed would benefit from improved riparian composition and structure, which would increase stream shading, improve LWD recruitment, and increase instream shelter to improve habitat conditions. General practices to improve riparian condition include protecting riparian areas (*e.g.*, increasing the number of riparian conservation easements), reducing riparian harvest, and implementing riparian planting and livestock exclusion fencing.

Address Riparian Road Sediment Sources

Riparian roads associated with various land uses exist throughout the basin. Problem roads and active erosion sites should be prioritized and addressed as part of a comprehensive sediment reduction plan at the subbasin level. The highest priority road is Cave Creek Road, which has multiple stream crossings and sediment sources (Ross Taylor and Associates 2003). Rural residential development must be closely monitored and managed by the County of Mendocino to minimize soil disturbance and sediment delivery to stream channels.

Increase Instream Shelter Ratings and Pool Volume

Shelter ratings are unsuitable in all surveyed stream reaches of the Tomki Creek watershed. Where applicable, restoration efforts should incorporate instream wood/boulder structures and/or large conifers (*i.e.*, fall trees into creek) within degraded reaches to improve shelter and overall habitat complexity.

Improve Passage

Remediating barriers to migration caused by road crossings would improve habitat utilization for both spawning adults and rearing juveniles. Improving low water crossings on Cave Creek would reduce sediment delivery into the stream and improve passage and spawning habitat quality.

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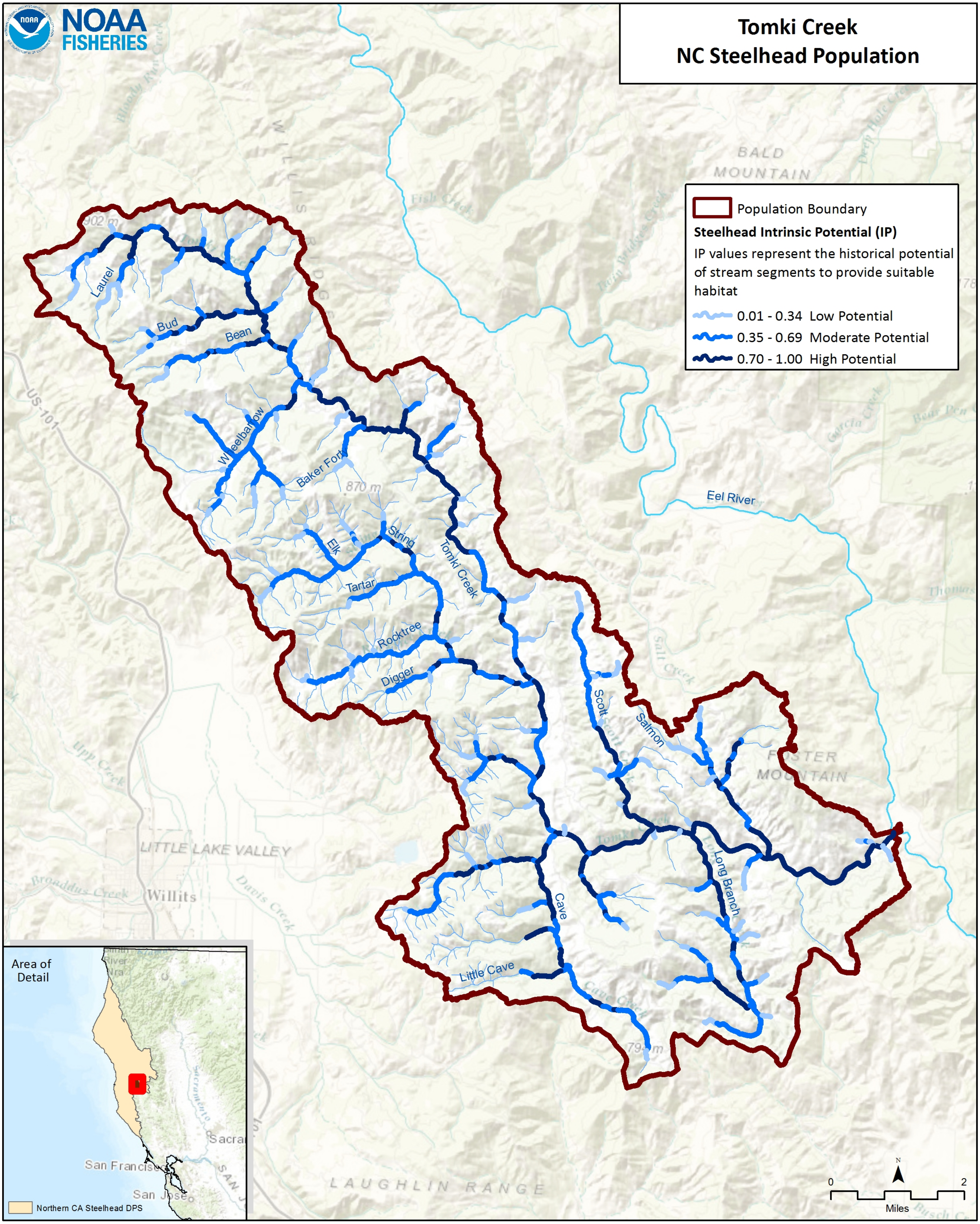

Tomki Creek
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
BALD MOUNTAIN
FOSTER MOUNTAIN
Eel River
Laurel
Bud
Bean
Wheelbarrow
Baker Fork
Elk
String
Tartar
Tomki Creek
Rocktree
Digger
Scott
Salmon
Long Branch
Cave
Little Cave
870 m
902 m
US-101
LITTLE LAKE VALLEY
Willits
LAUGHLIN RANGE
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
0
2
Miles

NC Steelhead Tomki Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	64% streams/ 41% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	≤39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43 % streams/ 64% IP-km (>50% stream average scores of 1 & 2)	Fair

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	14% streams/ 64% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	64% streams/ 41% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.39 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100 of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% of streams/ 14% IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	?39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43 % streams/ 64% IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	64% streams/ 41% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	?39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43 % streams/ 64% IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		<13,200 = Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.064% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.001% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	Fair
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.8 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.3 Miles/Square Mile	Poor

NC Steelhead Tomki Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low		Medium		Low	Low	Low
2	Channel Modification							
3	Disease, Predation and Competition			Medium		Medium		Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Medium				Low		Low
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Low	Low	Low	Medium	Low
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Low	Medium	Medium
9	Mining							
10	Recreational Areas and Activities			Low				Low
11	Residential and Commercial Development	Medium	Medium	Medium	Low	Low	High	Medium
12	Roads and Railroads	Medium	Medium	Medium	Low	Low	Medium	Medium
13	Severe Weather Patterns	Low	Low	High	Low	Low	Medium	Medium
14	Water Diversion and Impoundments	Low	Low	Very High	Low	Low	Low	High

Tomki Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ToC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ToC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
ToC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW.	2	10	CDFW, Fish Passage Forum, NMFS	
ToC-NCSW-5.1.1.2	Action Step	Passage	Evaluate, design and implement fish passage for adult and juvenile salmonids at road crossings on Cave Creek.	2	10	CDFW, Mendocino County Department of Public Works, NOAA RC, Private Landowners	
ToC-NCSW-5.1.1.3	Action Step	Passage	Evaluate the potential for adult passage at natural barriers within the Tomki Creek basin. Streams such as Little Cave Creek, Salmon Creek and upper Tomki Creek are a high priority for evaluation.	2	20	CDFW, NMFS, Private Landowners	
ToC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ToC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
ToC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches.	2	10	CDFW, NMFS, Private Landowners	
ToC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement a large woody debris supplementation program to increase stream complexity and gravel retention, and improve pool frequency and depth.	3	30	CDFW, NMFS, Private Landowners	
ToC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Improve frequency of large woody debris, root wads, and boulders to improve habitat complexity, and pools. Focus efforts in tributaries that currently have suitable stream temperatures such as tributaries to Cave Creek, upper Tomki Creek, String Creek, and tributaries in the northern area of the watershed.	3	20	CDFW, NMFS, NRCS, Private Landowners	
ToC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	25	CDFW, NMFS, NRCS, Private Landowners	
ToC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ToC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
ToC-NCSW-7.1.1.1	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	3	10	CDFW, NOAA RC, Private Landowners	
ToC-NCSW-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	3	10	CDFW, Mendocino County RCD, NMFS, Private Landowners	
ToC-NCSW-7.1.1.3	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	60	CalFire, CDFW, Mendocino County, NMFS, Private Landowners, RWQCB	
ToC-NCSW-7.1.1.4	Action Step	Riparian	Prioritize and plant riparian areas along Tomki creek and its tributaries. Based on CDFW habitat typing the following streams should be considered for riparian planting: Baker Forty Creek, Cave Creek, Little Cave Creek, Longbranch Creek, Tomki Creek, and Wheelbarrow Creek.	2	20	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
ToC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
ToC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
ToC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead through outreach and coordinated enforcement.	2	20	CDFW, NMFS, County	
ToC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Provide additional funding for CDFW law enforcement to improve protection from poaching activities in the Tomki Creek watershed.	2	10	CDFW	
ToC-NCSW-22.1	**Objective**	**Residential/ Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ToC-NCSW-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance				
ToC-NCSW-22.1.1.1	Action Step	Residential/ Commercial Development	Work with agencies to minimize potential impacts to salmonid habitat from existing and future residential developed property.	3	25	CDFW, Mendocino County, NMFS	
ToC-NCSW-22.1.1.2	Action Step	Residential/ Commercial Development	Coordinate with local watershed groups to work with private property owners on projects to minimize sediment production, water use, and other activities that degrade aquatic habitat.	3	20	County of Mendocino, NOAA RC, Private Landowners, Public	

Tomki Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ToC-NCSW-22.1.1.3	Action Step	Residential/ Commercial Development	Work with Mendocino County Planning and building to minimize future development in the Tomki Creek watershed.	3	5	CDFW, Mendocino County, NMFS	
ToC-NCSW-22.1.1.4	Action Step	Residential/ Commercial Development	Efforts to minimize sediment production, and water diversion associated with existing rural residential land use should focus on the Scott, Salmon, Longbranch, and Cave Creek subbasins.	2	20	County of Mendocino, NOAA RC, Private Landowners, Public	
ToC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ToC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
ToC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners	
ToC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Based on the Sediment Reduction Plan, implement riparian road upgrades at high priority sites.	2	10	CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners	
ToC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Work with the County of Mendocino DOT to upgrade existing high priority riparian road segments identified by the county. Focus on upgrades and crossings in Cave Creek along Tomki Road.	2	10	CDFW, County of Mendocino, NMFS	
ToC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority riparian roads (including private roads or driveways), or those identified in the Sediment Reduction Plan.	2	10	CDFW, NMFS, Private Landowners	
ToC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ToC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
ToC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	2	25	NMFS, CDFW, Private Landowners	
ToC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Develop off channel water storage for grazing, cannabis, and rural residential users within the watershed to increase summer surface flow across the watershed.	1	20	CDFW, Private Landowners	
ToC-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
ToC-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
ToC-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Minimize unauthorized water diversions with the use of coordinated law enforcement efforts.	2	10	NMFS, CDFW, County	
ToC-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Coordinate with County of Mendocino Marijuana Eradication Team to develop enforcement actions associated with illegal water diversions in the Tomki Creek watershed.	2	10	CDFW, COMMET, NMFS OLE	

Woodman Creek Population

NC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Lower Interior
- Spawner Abundance Target: 1,300 adults
- Current Intrinsic Potential: 35.0 IP-km

For information regarding CC Chinook salmon and SONCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Few records exist that inform historic steelhead abundance within Woodman Creek. A California Department of Fish and Wildlife (CDFW) stream inventory report from 1981 documents juvenile steelhead inhabiting Woodman Creek downstream of the White Rock Creek confluence, however, fish density was low and steelhead were "not abundant" (CDFG 1981). Later surveys in 1995 and 1998 confirmed widespread distribution of juvenile steelhead throughout the survey section of mainstem Woodman Creek and two small tributaries (CDFG 1995; 1998a; 1998b; 1998c). No adult spawning or carcass surveys have been conducted in the watershed. Steelhead are distributed throughout much of the Woodman Creek watershed, although impassable road crossings preclude passage into the upper reaches of a few smaller tributaries (Becker and Reining 2009). White Rock Creek, the largest tributary in the watershed, contains approximately 5 miles of high quality rearing and spawning habitat (Becker and Reining 2009). The railroad crossing near the Woodman Creek / Eel River confluence is considered a passage impediment at most flows, likely impeding upstream passage of adult steelhead into the watershed.

History of Land Use

The Woodman Creek watershed area has both Federal and private land holdings, with much of the private land managed for rural development. Large areas within the headwater reaches of Woodman Creek and White Rock Creek are managed by the U.S. Bureau of Land Management. Although little logging has occurred within the basin in the past few decades (less than 0.03 percent during the past 14 years; NMFS GIS Data), past logging intensity was much higher during the early and mid 20th century when much of the Eel River basin underwent heavy timber harvest. PWA (2005) indicates that much of the Woodman Creek watershed was heavily tractor-logged during the 1950s, prior to being subdivided in the 1960s for non-industrial timber harvest, recreation, livestock grazing and rural residences. Currently, the majority of private land within the Woodman Creek watershed consists of large parcels that are slowly being developed as rural residential properties.

Current Resources and Land Management

Approximately one-quarter of the Woodman Creek watershed is managed by the U.S. Bureau of Land Management (USBLM). The remaining watershed is privately owned.

Salmonid Viability and Watershed Conditions

The following habitat attributes were rated Poor through the CAP process: habitat complexity, fish passage, riparian vegetation, viability, and sediment. Recovery strategies will typically focus on ameliorating these habitat attributes, although strategies that address other attributes may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Woodman Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Woodman Creek watershed are poor within all sampled reaches. Poor to Fair LWD ratings were also documented Habitat Complexity: large wood conditions have a rating of Poor for summer rearing juveniles, smolts and adults, due largely to a lack of functional riparian corridors and recruitment of large conifer species from adjacent upslope areas.

Riparian Vegetation: Composition, Cover & Tree Diameter

Although canopy cover within Woodman Creek is generally good throughout all CDFW surveyed reaches, few riparian trees are of a suitable size to recruit to the stream channel and function as high quality LWD. Approximately 17 percent of riparian trees within surveyed reaches of Woodman Creek were considered Class 5 and 6; any measurement below 40 percent is indicative of poor riparian tree size.

Sediment: Gravel Quality and Distribution of Spawning Gravels

High levels of instream fine sediment impair steelhead spawning and summer rearing habitat quality in Woodman Creek. All surveyed reaches exhibited poor gravel embeddedness scores, suggesting that elevated fine sediment is an ongoing problem throughout much of the basin.

Sediment transport from upslope sources is also likely a problem within the basin, given the high density of unimproved roads within riparian areas.

Passage/Migration: Mouth on Confluence and Physical Barriers

Few passage barriers exist in the Woodman Creek basin, and those that do exist are typically poorly functioning road crossings located within the headwater reaches of smaller tributaries. However, several passage impediments occur within the lower mainstem of Woodman Creek, most importantly the engineered fish channel below the railroad crossing that precludes adult fish passage at some flow levels. Passage and migration conditions were rated as Poor due to the engineered fish channel that can influence fish passage to the entire watershed.

Viability: Density, Abundance, and Spatial Structure

The viability of the Woodman Creek steelhead population is likely reduced as compared to historical numbers, as suggested by the low juvenile abundance witnessed during recent habitat surveys. The cause of the observed low juvenile abundance is unknown at this time, but may be related to poor adult passage into the watershed, or poor egg to fry survival resulting from highly embedded spawning gravel. It is unknown if summer flow volume is currently limiting steelhead abundance in the basin.

Other Current Conditions

Watershed hydrology in Woodman Creek appeared to be adequate when summer discharge was measured during CDFW habitat surveys in 1981, 1995 and 1998a. Likewise, summer stream temperatures are thought to adequately support successful steelhead rearing, with measured water temperatures usually between 60 and 70°F (CDFG 1998a). However, more recent data on seasonal stream flow patterns are needed to determine if the unimpaired conditions observed in the 1990's continue to persist on an annual basis. Increased rural residential development over the last decade could be reducing summer flow in this basin.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see in Woodman Creek CAP results). Recovery strategies will likely focus on ameliorating high rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Woodman Creek CAP results.

Roads and Railroads

Overall road density within the Woodman Creek watershed is fairly low (1.8 road miles/square mile watershed area), with a higher road density found within the White Rock Creek drainage than the southern half of the watershed. Of concern within the watershed is the high road density occurring within stream riparian corridors (2.2 mile/square mile). Riparian roads can more effectively deliver road sediment to the stream channel than upslope roads due to their close proximity to aquatic environment. Furthermore, many of the riparian roads in Woodman Creek confine the stream channel and prevent lateral channel migration, thus impairing natural fluvial and geomorphic processes responsible for creating and maintaining instream habitat features.

Road and railroad stream crossings impair steelhead migration patterns within the Woodman Creek watershed. As mentioned above, the engineered fish channel adjacent the railroad crossing at the Woodman Creek confluence likely impedes upstream adult steelhead passage at most flows. Some road crossings block access into the headwater reaches of some smaller tributary streams.

Other Threats

There are no fish hatcheries in operation within the Woodman Creek watershed, so hatchery-related effects are unlikely for this population. Similarly, invasive species are not known to be problematic within the basin. Land clearing and road building associated with rural residential development is a significant concern within the basin, primarily within the White Rock Creek subwatershed. No dams or water impoundments existed within the basin, and summer baseflows were apparently adequate during the most recent surveys (CDFG 1981; 1995; 1998a). However, based on observations in other areas of the Eel River Watershed, rural residential development and cannabis growing has expanded in the Woodman Creek drainage, which has likely resulted in additional stream flow diversions or groundwater pumping. These additional stresses to Woodman Creek would reduce the quality and extent of habitat for steelhead during the dry season.

Limiting Stresses, Life Stages, and Habitats

Threat and stress analysis within the CAP workbook suggests adult migration and spawning success is likely a limiting factor affecting steelhead abundance within the Woodman Creek watershed. Adult passage into and through the Woodman Creek system is impaired at several locations, and high levels of in-channel fine sediment documented by embeddedness scores suggests spawning gravel quality is poor. Restoration actions should target addressing these issues within high potential stream reaches.

General Recovery Strategy

Evaluate and Address Passage Impediment/Barriers

The railroad crossing at the mouth of Woodman Creek impedes adult steelhead passage. Other road crossings within the basin may impede or preclude upstream passage for both adult and juvenile fish. All potential passage barriers/impediments should be investigated, and high priority sites addressed.

Numerous landslides have been noted within the Woodman Creek basin, and many are actively delivering fine sediment directly to stream channels (CDFG 1981; 1995; 1998a). A sediment assessment for the basin has already been performed (PWA 2005); high priority sites identified within the report should be addressed as restoration opportunities arise.

Shelter ratings were low within all surveyed stream reaches of Woodman Creek. Due largely to an absence of LWD, available shelter components are comprised mainly of boulders and aquatic vegetation. Where applicable, restoration efforts should incorporate instream wood/boulder structures into degraded reaches to improve habitat complexity and shelter availability.

Literature Cited

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CDFG (California Department of Fish and Game). 1998c. Stream Inventory Report: Unnamed tributary #2 to Woodman Creek.

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NOAA FISHERIES
Woodman Creek
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles
N
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
Sacramento
Eel River
Woodman
White Rock
Iron
Iron Peak Rd
Iron Creek Rd
Dunham Rd
Simmerly Rd
Iron Stivers Rd
Woodman Peak Rd
Corbet Creek
Laytonville
Poorkinney Rd

NC Steelhead Woodman Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	100% of streams/IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	17% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	25% of streams/ 13% of IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition		Impaired/non-functional	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	25% of streams/ 9% of IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	100% of streams/IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	100% of streams/ IP-km (>70% average stream canopy)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	17% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	25% of streams/ 13% of IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	100% of streams/IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	17% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	25% of streams/ 13% of IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition		Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.051% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	0.03% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.8 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.2 Miles/Square Mile	Poor

NC Steelhead Woodman Creek CAP Threat Results

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific-threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Low	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Medium	Medium	Medium	Low	Medium
3	Disease, Predation and Competition	Medium	Low	Low	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Low		Low		Low		Low
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low		Low
8	Logging and Wood Harvesting	Low	Low	Low	Low	Low	Low	Low
9	Mining	Low	Low	Low	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Low	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Low	Medium	Low	Medium	Low	Medium
12	Roads and Railroads	High	Medium	High	Medium	High	Medium	High
13	Severe Weather Patterns	Medium	Low	Medium	Medium	Medium	Low	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Medium	Medium	Low	Medium

Woodman Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WmC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WmC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
WmC-NCSW-3.1.1.1	Action Step	Hydrology	Maintain or improve flow through a forbearance program or other incentives.	1	10	CDFW, NMFS, RWQCB	Although reports from the 1990's suggest there used to be adequate flows, this does not mean it is still the case. Woodman Creek is one of the few cooler water tributaries in the area. Preserving water to keep Woodman flowing is a top priority.
WmC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WmC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
WmC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW.	2	10	CDFW, NOAA RC, RCD	
WmC-NCSW-5.1.1.2	Action Step	Passage	Implement fish passage projects based on priority from list developed by CDFW.	2	10	CDFW, CDFW, NMFS, Private Landowners	
WmC-NCSW-5.1.1.3	Action Step	Passage	Investigate and improve passage at the railroad tressel near the confluence of Woodman Creek and the Eel River.	1	5	CDFW, NMFS	
WmC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WmC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings				
WmC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Utilize existing watershed analyses or habitat surveys, or conduct new analyses where needed, in order to prioritize restoration actions that improve instream habitat complexity.	2	20	CDFW, NMFS, RCD, Private Landowners	
WmC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Complete habitat surveys to document habitat quality and availability within the watershed.	2	10	CDFW, NMFS	
WmC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Conduct outreach with private landowners in order to complete habitat surveys and establish restoration priorities on private lands.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
WmC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve large wood frequency				
WmC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
WmC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
WmC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
WmC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WmC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
WmC-NCSW-7.1.1.1	Action Step	Riparian	Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for steelhead and Chinook salmon (CDFG 2004).	3	50	CDFW, NMFS, Private Landowners	
WmC-NCSW-7.1.1.2	Action Step	Riparian	A comprehensive evaluation and monitoring program should be implemented to determine areas where poor riparian habitat is producing water temperatures that limit juvenile steelhead survival.	1	10	CDFW, NMFS, Private Landowners	
WmC-NCSW-7.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	100	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
WmC-NCSW-7.1.1.4	Action Step	Riparian	Fence riparian areas within the watershed from grazing by using fencing standards that allow other wildlife to access the stream.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	

Woodman Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WmC-NCSW-7.1.1.5	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, ivy, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	2	20	CDFW, NMFS, NOAA RC, NRCS, RCD	
WmC-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
WmC-NCSW-7.1.2.1	Action Step	Riparian	Manage riparian areas for their site potential composition and structure.	1	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
WmC-NCSW-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
WmC-NCSW-8.1	**Objective**	**Sediment**	**Address the inadequacy of existing regulatory mechanisms**				
WmC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
WmC-NCSW-8.1.1.1	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with NC steelhead and CC Chinook salmon recovery priorities.	2	20	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
WmC-NCSW-8.1.1.2	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis (e.g., Woodman Creek Watershed Assessment and Restoration Planning Project (PWA 2005)), CDFW, or CalFire.	2	10	CDFW, NMFS	
WmC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WmC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
WmC-NCSW-11.1.1.1	Action Step	Viability	Conduct a comprehensive assessment of watershed processes (e.g., hydrology, geology, fluvial-geomorphology, water quality, and vegetation), instream habitat, and factors limiting Chinook salmon and steelhead production.	2	5	CDFW, NMFS, Private Landowners	
WmC-NCSW-11.1.1.2	Action Step	Viability	Monitor population status for response to recovery actions.	3	10	CDFW, NMFS, Private Landowners	
WmC-NCSW-11.1.1.3	Action Step	Viability	Utilize CDFW approved implementation, effectiveness, and validation monitoring protocols when assessing efficacy of restoration efforts.	2	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
WmC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
WmC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
WmC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
WmC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WmC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
WmC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners	
WmC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement riparian road upgrades at high priority sites identified in the sediment reduction plan.	3	15	CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners	

NC Steelhead DPS Rapid Assessment Profile: Lower Interior/North Mountain Interior Diversity Strata Populations

Dobbyn Creek

- Role within DPS: Potentially Independent Population
- North Mountain Interior Diversity Strata
- Spawner Abundance Target: 280-562 adults
- Current Intrinsic Potential: 47.0 IP-km

Jewett Creek

- Role within DPS: Independent Population
- Lower Interior Diversity Stratum
- Spawner Abundance Target: 99-200 adults
- Current Intrinsic Potential: 16.8 IP-km

Bell Springs

- Role within DPS: Potentially Independent Population
- Lower Interior Diversity Stratum
- Spawner Abundance Target: 107-215 adults
- Current Intrinsic Potential: 18.1 IP-km

Garcia Creek

- Role within DPS: Dependent Population
- Lower Interior Diversity Stratum
- Spawner Abundance Target: 83-167 adults
- Current Intrinsic Potential: 14.1

Soda Creek

- Role within DPS: Dependent Population
- Lower Interior Diversity Stratum
- Spawner Abundance Target: 92-186 adults
- Current Intrinsic Potential: 15.7 IP-km

Bucknell Creek

- Role within DPS: Dependent Population
- Lower Interior Diversity Stratum
- Spawner Abundance Target: 52-106 adults
- Current Intrinsic Potential: 9.0 IP-km

Abundance and Distribution

These populations are all in larger tributaries to the mainstem Eel River that were included in the recovery plan to provide connectivity between populations along the mainstem Eel River from the South Fork Eel River Confluence to Scott Dam. Five tributaries, Bell Springs, Bucknell, Jewett, Garcia and Soda creeks, are part of the Lower Interior diversity stratum and Dobbyn Creek is within the North Mountain Interior Stratum. Dobbyn Creek enters the lower reach of mainstem Eel River in the northern area of the basin, north of Alderpoint. The Jewett Creek watershed is located approximately three miles upstream of the small town of Alderpoint in Humboldt County. Bell Springs Creek flows from the west and enters the Eel River directly across from the North Fork Eel River confluence. Garcia Creek is tributary to the Upper Middle Mainstem Eel River and flows south, entering the Eel River at about stream mile 147. Soda Creek and Bucknell Creek are located in the upper reach of the mainstem Eel River just downstream of Scott Dam and Lake Pillsbury.

Currently, steelhead are present in all of these tributaries but surveys have not been conducted since the late 1990s. Dobbyn Creek, the largest of these tributaries, has steelhead present throughout most of the watershed and was stocked heavily in the 1930s. Bell Springs Creek is similar with steelhead presence confirmed by CDFW biologists in 1996 (Becker and Reining 2009). These CDFW surveys observed juvenile steelhead from the mouth of Bell Springs Creek upstream 3.4 miles where a series of falls is reported to limit anadromy. Bucknell and Soda creeks represent very important tributaries in the upper reach of the mainstem Eel River between the Van Arsdale Fish Station (VAFS) and Scott Dam. According to a stream survey conducted by CDFW in 1995, stream reaches in Bucknell Creek had about five juvenile steelhead per 100 feet. Anadromous habitat in this tributary extends approximately 4.8 miles upstream to a series of waterfalls that limits anadromous passage. Two tributaries, Welch Creek and Panther Creek, meet to form Soda Creek which is the upper most tributary to the mainstem Eel River prior to Scott Dam which forms Lake Pillsbury. Currently, most of the Soda Creek reach, which is about three miles long, is dry or intermittent during the summer months. Juvenile steelhead are present in both Panther and Welch creeks, with Welch Creek providing cooler summer stream temperatures, but limited flow in some years (L. Morgan, USFS, personal communication, 2013). USFS surveys in Garcia Creek and its tributaries in 1973 observed "salmonids" at low densities in the downstream reaches of the creek and increased numbers of juveniles in the upper reaches. Electrofishing conducted in a number of Eel River tributaries in 1981 as part of PG&E's Potter Valley Project Fisheries Study found juvenile steelhead in Garcia Creek (VTN 1982), and similar summer sampling in 1989 and 1990 found steelhead in Jewett Creek (Brown and Moyle 1991).

History of Land Use, Land Management and Current Resources

Following WWII, mechanized logging was conducted in many areas of the watershed. Due to the near-absence of regulations, many areas were harvested with poor logging practices including road construction on steep hillsides. In the harvested areas, the watershed was then susceptible to massive erosion as the result of record rainfall and floods in 1955 and 1964 (USEPA 2005). The erosion resulted in increased sediment being deposited in stream channels, filling in most deep pools (Lisle 1982). Stream reaches became wide and shallow, with reduced riparian vegetation for stabilization or shade. According to USEPA (2005) most sediment production from 1940-2005 came from natural sources (68%), and roads are the cause of the human related sediment, accounting for 26% of sediment production. Following the 1964 flood, populations of anadromous fish did not recover, and recovery was made even more difficult by the illegal introduction and explosive population expansion of the predatory Sacramento pikeminnow in 1979 (Brown and Moyle 1997).

In parts of the mainstem Eel River basin, grazing and residential development has increased over time that has further degraded stream reaches. Since the passage of Proposition 215, the Compassionate Use Act of 1996, many watersheds in northern Mendocino County such as the Eel River have seen increases in rural residential development associated with cannabis production.

Diversity Stratum Population and Habitat Conditions

Based on limited stream survey information, only habitat conditions associated with streamflow were rated as Poor for the mainstem Eel River tributaries described above. Fair and Poor habitat conditions for these tributaries are associated with reduced streamflow during the summer period that limits rearing capacity for the juvenile steelhead. Also, passage conditions at road crossings and natural boulder roughs reduce habitat availability in Dobbyn, Bell Springs, and Soda creeks. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on the conditions is abated. The following discussion focuses on those conditions that are rated as Poor or Fair for steelhead life history stages (see "Lower Interior Diversity Stratum and North Mountain Interior Stratum" Rapid Assessment Results). These were summer streamflows, passage and migration, instream habitat complexity, gravel quality and quantity, fish abundance, and stream temperatures.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of all Eel River salmonid populations. The Eel River estuary is severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. CDFG (2010) estimates there has been a 90-percent reduction in the amount of historic wetland habitat in the estuary, and a similar reduction in the amount of water entering and leaving the estuary with the rise and fall of the tide. For more information regarding the Eel River estuary please see the Lower Mainstem Eel's Rapid Assessment and the Eel River Overview.

Hydrology: Baseflow and Passage Flows

Historic summer flow conditions in the hot interior areas of the Eel River system can limit juvenile fish production. Stream diversions that are occurring in these systems can have an effect on quality and quantity of available habitat for juvenile fish during summer and fall low flow periods.

Passage/Migration: Mouth or Confluence and Physical Barriers

Passage conditions in these tributaries are typically impacted by existing road crossings in smaller channels that could provide rearing opportunities for juvenile steelhead. Road culverts and in some cases natural high-gradient boulder reaches limit the extent of anadromous use in these streams.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The lack of pools in tributary streams likely limits the space available for juvenile fish attempting to maintain territory for feeding and predator avoidance. Lack of pool habitats within this basin likely stems from high instream sediment concentrations (pool filling), reduced flow and loss of LWD recruitment from past land use practices.

Habitat Complexity: Large Wood and Shelter

Past timber harvesting of large conifers such as Douglas Fir and Pine species has reduced recruitment of LWD to stream channels. Unlike coastal redwoods, these species do not produce stump sprouts, making it difficult to re-grow riparian areas that mimic historic conditions. The majority of habitat complexity in these interior tributary streams is in the form of boulders and bedrock that forms the pool riffle sequences.

Sediment: Gravel Quality and Distribution of Spawning Gravels
Highly erodible soils in the Eel River system along with past land use practices have increased sediment delivery to stream channels. Natural sediment delivery rates are high across the watershed, with about a quarter of the current sediment delivery associated with human related activities. Fine sediment delivery from road systems causes elevated fine sediment levels that reduce egg survival in redds and impact food production for rearing fish.

Viability: Density, Abundance and Spatial Structure
Low numbers of adult steelhead returning to the mainstem Eel River at the VAFS suggests that spawning numbers in the tributaries are also relatively low. Typically the VAFS passes between 250-500 adult steelhead to the upper most reaches of the Eel River that includes Bucknell and Soda creeks.

Water Quality: Temperature
Stream temperatures are marginal for salmonid rearing in the warm interior area of the Eel River watershed. Data collected during 1996 show maximum weekly temperatures (MWATs) of greater than 20 C in Dobbyn and Panther creeks and an MWAT of 19.4 C in Bucknell Creek (Friedrichsen 1998).

Threats

The following discussion focuses on those threats that rate as a primary or secondary concern (see "Lower Interior Diversity Stratum and North Mountain Interior Stratum" Rapid Assessment Results). Recovery strategies will focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in "Lower Interior Diversity Stratum and North Mountain Interior Stratum" Rapid Assessment Results.

Logging and Wood Harvesting
The potential for landslides is extremely high in across the Eel River watershed. The majority of the sediment delivered to stream channels was found to be from natural debris slides (68%) (USEPA 2005). Timber harvest is reported to contribute about 7 percent of the sediment in the Middle Mainstem Eel River; therefore, it was rated as Fair in its contribution to impairment of pool frequency. Reduction in riparian canopy from timber harvesting was also rated as Fair in altered riparian species, and reduced LWD and complexity.

Residential and Commercial Development
Rural residential development will likely become a High threat in the future. We attempt to capture this threat in the water diversion section above, but other impacts from rural residential development, such as land clearing, water uses, and road building, are likely to increase in the future.

Roads and Railroads
The road related sediment production in all four tributary watersheds is generated from both private roads and USFS roads on Soda and Bucknell creeks. USEPA (2005) reports that roads generate an average of 80 tons/mile per year from road landslides, and 104 ton/mile per year from gullies and stream crossing failures across the Middle Mainstem Eel River watershed area. Riparian roads associated with multiple land uses are an increased concern due to their capacity to deliver fine sediment to spawning and rearing reaches. At low water road crossings on perennial streams there is a high potential for sediment delivery, which is elevated at crossing used in the winter months.

Severe Weather Patterns
Large flood events and drought are the greatest threat to this highly erosive watershed. Past flood events in 1995 and 1964 have had devastating effects to salmonid habitat by filling pools that are required in the summer for both adults and juvenile steelhead. Drought conditions can reduce migration potential for both winter and summer steelhead and reduce suitability of stream temperature in the spring and summer through reductions in snowpack and subsequent runoff.

Water Diversion and Impoundments
Cannabis production is a serious and growing threat in this watershed. Water diversion by large cannabis cultivators and associated rural residential water use is reducing summer baseflow. We base this conclusion on information from nearby basins such as Outlet Creek (LeDoux-Bloom and Downie 2008), and personal communications with biologists conducting field surveys in the Eel River watershed (P. Steiner, CDFG, personal communication 2011; L. Morgan, USFS, personal communication 2012). Given the continued prohibition of cannabis production, this threat is likely to continue to impact summer baseflow conditions for juvenile salmonids over the next decade. All of these tributaries are known areas for cannabis production. Rural residential development associated with cannabis production also uses water from groundwater and springs that likely impacts summer rearing conditions for juvenile steelhead.

Fishing and Collecting

Given the remote conditions that exist for rural residents living near these tributaries, poaching and illegal fishing occurs by residents. Steelhead are very susceptible to poaching with spears, nets, and large treble hooks when adult fish are spawning in small tributary streams (T. Daugherty, NMFS, personal communication, 2015).

Limiting Conditions, Lifestages, and Habitats

Given the natural hydrology of this interior area of the Eel River watershed, we find that the conditions of summer flow are likely limiting steelhead production in these tributary streams. Stream diversions from rural residential and cannabis production are the greatest threats to these streams. Impaired fish passage at road crossings and high gradient reaches impacts steelhead distribution and habitat utilization in small headwater reaches. Fine sediment generated from rural roads contributes to habitat degradation by reducing food production and spawning success.

General Recovery Strategy

Our approach to recover steelhead in tributary streams in mainstem Eel River is to work closely with landowners to reduce water diversions during the summer low flow period and to improve rural road systems to reduce sediment production. Fish passage sites need to be evaluated and projects developed to improve habitat availability in high gradient tributary streams within these strata.

In general, recovery strategies focus on improving conditions and ameliorating conditions and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in this Stratum are discussed below with more detailed and site-specific recovery actions provided in "Lower Interior Diversity Stratum and North Mountain Interior Stratum" Rapid Assessment.

Water Diversion and Groundwater Extraction

Reduced and disconnected flow conditions (*e.g.*, dry stream reaches) resulting from water diversions and groundwater pumping are likely reducing juvenile steelhead survival in tributaries where rural residential development is concentrated. Federal, state, local government, or community based representatives should work with landowners to implement solutions that minimize these effects; solutions should examine conservation methods, water management planning, and water storage and recharge solutions. In addition, improved coordination between NMFS, CDFW, State Water Resources Control Board (Division of Water Rights) and county law enforcement agencies must occur to reduce the number of illegal stream diversions in these tributaries.

Address Road Sediment Sources

Many roads need to be upgraded to reduce fine sediment delivery into streams. Problem roads and active erosion sites should be prioritized and addressed as part of a comprehensive sediment reduction plan at the subwatershed level. Rural residential development must be closely monitored and managed by Lake and Mendocino counties to minimize soil disturbance and sediment delivery to stream channels.

Increase Instream Shelter Ratings and Pool Volume

Shelter ratings are generally unsuitable in most tributary stream reaches in this assessment. Due largely to an absence of LWD, pool habitat quality is poor and shelter consists of undercut banks, boulders and aquatic vegetation. Where applicable, restoration efforts should incorporate instream wood/boulder structures and/or large conifers (*i.e.*, fall trees into creek) within degraded reaches to improve shelter and overall habitat capacity.

Improve Passage

Remediating barriers to migration caused by road crossings would improve fish distribution/habitat availability for both spawning adults and rearing juveniles. Investigate improving passage on Bell Springs Creek at the series of waterfalls located 3.4 miles up from mouth. Also investigate passage improvement at the large slide on Panther Creek, a tributary to Soda Creek. Other manmade barriers documented in the Fish Passage Assessment database should be investigated to determine the potential to improve or restore passage to spawning and rearing to headwater reaches of the tributary streams in this assessment.

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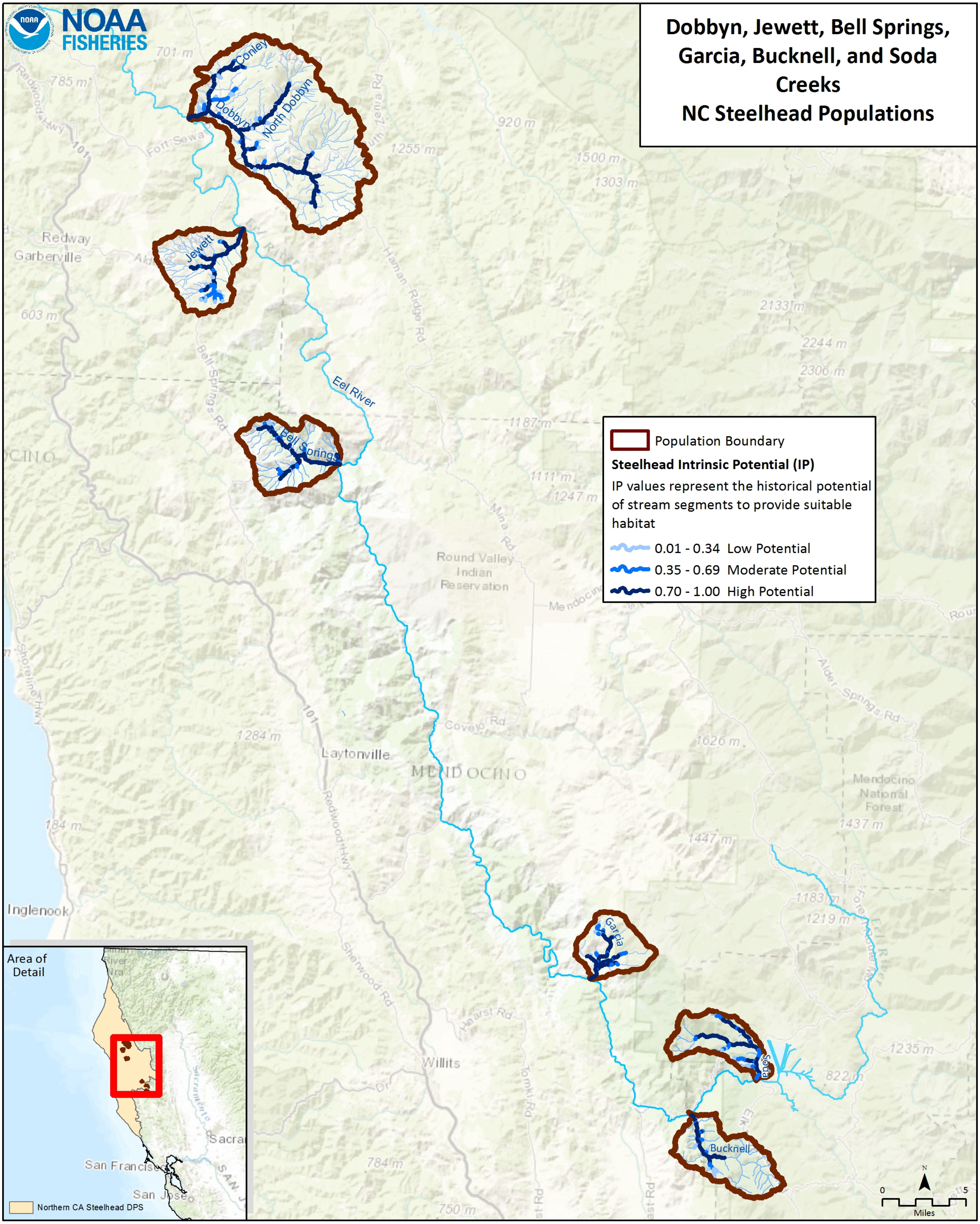

NOAA FISHERIES
Dobbyn, Jewett, Bell Springs, Garcia, Bucknell, and Soda Creeks
NC Steelhead Populations
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Conley
Dobbyn
North Dobbyn
Jewett
Bell Springs
Eel River
Garcia
Soda
Bucknell
Redway
Garberville
Laytonville
Willits
Inglenook
Round Valley Indian Reservation
Mendocino National Forest
MENDOCINO
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
Miles
0
5

NC Steelhead DPS: Lower Interior and North Mountain Interior (Bell Springs/Bucknell/Dobbyn/Soda/Jewett/Garcia)						
Habitat & Population Condition Scores By Life Stage: VG = Very Good G = Good F = Fair P = Poor		Steelhead Life History Stages				
		Adults	Eggs	Summer-Rearing Juveniles	Winter-Rearing Juveniles	Smolts
Stresses: Key Attribute: Indicators	Riparian Vegetation: Composition, Cover & Tree Diameter			G	G	
	Estuary: Quality & Extent	P		P		P
	Velocity Refuge: Floodplain Connectivity	VG			VG	VG
	Hydrology: Redd Scour		G			
	Hydrology: Baseflow & Passage Flows	G	G	P		G
	Passage/Migration: Mouth or Confluence & Physical Barriers	F		G	F	VG
	Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios	G		F	G	
	Habitat Complexity: Large Wood & Shelter	G		F	F	F
	Sediment: Gravel Quality & Distribution of Spawning Gravels	G	F	G	G	
	Viability: Density, Abundance & Spatial Structure	F		F		F
	Water Quality: Temperature			F		G
	Water Quality: Turbidity & Toxicity	G		G	G	G

NC Steelhead DPS: Lower Interior and North Mountain Interior (Bell Springs/Bucknell/Dobbyn/Soda/Jewett/Garcia)

Threat Scores
L: Low
M: Medium
H: High

Threats - Sources of Stress	Stresses: Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Agriculture	L	L	L	L		L	L	L	L		L	L
Channel Modification	L	H	L	L	L	L	L	L	L		L	L
Disease, Predation, and Competition	L	L	L			L	L	L		L	L	L
Fire, Fuel Management, and Fire Suppression	L	L	L	L		L	L	L	L		L	L
Livestock Farming and Ranching	L	L	L	L		L	L	L	L		L	L
Logging and Wood Harvesting	L	M	L	L		L	M	M	L		L	L
Mining	L	L	L	L		L	L	L	L		L	L
Recreational Areas and Activities	L	L	L	L		L	L	L	L		L	L
Residential and Commercial Development	L	M	L	L		L	L	L	L		L	L
Roads and Railroads	L	L	L	L		M	L	L	M		L	L
Severe Weather Patterns	L	L	L	L	H	L	L	L	L		M	L
Water Diversions and Impoundments	L	M	L	L	H	M	L	L	L	L	M	L
Fishing and Collecting										M		
Hatcheries and Aquaculture										L	L	L

Dobbyn Creek, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DobC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DobC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
DobC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	10	CDFW, Mendocino County RCD, NOAA RC, Private Landowners	
DobC-NCSW-3.1.1.2	Action Step	Hydrology	Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the dry season.	1	4	CDFW, NMFS, Private Landowners, SWRCB	
DobC-NCSW-3.1.1.3	Action Step	Hydrology	Implement a summer water conservation program for rural residential water users that affect tributaries of the mainstem Eel River.	2	10	CDFW, NOAA RC, Private Landowners	
DobC-NCSW-3.1.1.4	Action Step	Hydrology	Work with law enforcement to reduce or eliminate illegal water diversions.	2	5	CDFW Law Enforcement, NMFS OLE, SWRCB, USFS	
DobC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DobC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical barriers to passage				
DobC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS, NOAA RC, Private Landowners	
DobC-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	5	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
DobC-NCSW-5.1.1.3	Action Step	Passage	Evaluate the extent and quality of steelhead habitat on Mud Creek above Zenia Bluff Road (Dobbyn Creek watershed) and implement restoration of passage if sufficient habitat exists to justify removing the road barrier.	2	1	NOAA RC, Private Landowners	
DobC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DobC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pool, LWD, and shelters				
DobC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine beneficial locations and amount of instream structure needed based on the assessment.	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS	
DobC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions to increase instream shelter, and velocity refuge.	2	10	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
DobC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DobC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
DobC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004)	2	10	CDFW, Mendocino County RCD, NMFS	
DobC-NCSW-7.1.1.2	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
DobC-NCSW-7.1.1.3	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting and other vegetation management to encourage the development of a denser more extensive riparian canopy.	2	20	CDFW, NOAA RC, Private Landowners, RWQCB	
DobC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DobC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
DobC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop plan to decommission, upgrade or maintain roads. Specific road plans should be developed for roads in the Dobbyn Creek watersheds.	2	10	Humboldt County Department of Public Works, NOAA RC, Private Landowners, RWQCB	
DobC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
DobC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				

Dobbyn Creek, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DobC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with NC steelhead summer flow needs	2	25	CDFW, NMFS, Private Landowners, SWRCB	
DobC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Work with landowners to bypass flow and conserve water during critical low flow periods.	2	25	CDFW, NOAA RC, Private Landowners, SWRCB	
DobC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DobC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
DobC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Establish a forbearance program, using water storage tanks for rural residential users to decrease diversion during periods of low flow.	2	10	NOAA RC, Private Landowners, SWRCB	
DobC-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
DobC-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
DobC-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	
DobC-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	2	25	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	

Jewett Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
JewC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JewC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
JewC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	10	CDFW, Humboldt County RCD, NOAA RC, Private Landowners	
JewC-NCSW-3.1.1.2	Action Step	Hydrology	Develop critical flow values for consideration as the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the summer and fall dry seasons.	1	4	CDFW, NMFS, Private Landowners, SWRCB	
JewC-NCSW-3.1.1.3	Action Step	Hydrology	Implement a summer water conservation program for rural residential water users that affect tributaries of the mainstem Eel River.	2	10	CDFW, NOAA RC, Private Landowners	
JewC-NCSW-3.1.1.4	Action Step	Hydrology	Work with law enforcement to reduce or eliminate illegal water diversions.	2	5	CDFW Law Enforcement, NMFS OLE, SWRCB, USFS	
JewC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JewC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical barriers to passage				
JewC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW	2	5	CDFW, Humboldt County, Humboldt County RCD, NMFS, NOAA RC, Private Landowners	
JewC-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines.	2	5	CDFW, Humboldt County RCD, NOAA RC, NRCS, Private Landowners	
JewC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JewC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pool, LWD, and shelters				
JewC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Work with agencies to assess habitat and determine beneficial locations lacking in habitat complexity and add instream structure.	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS	
JewC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions to increase instream shelter, and velocity refuge.	2	10	CDFW, Humboldt County RCD, NOAA RC, NRCS, Private Landowners	
JewC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JewC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
JewC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004)	2	10	CDFW, Humboldt County RCD, NMFS	
JewC-NCSW-7.1.1.2	Action Step	Riparian	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
JewC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
JewC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
JewC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
JewC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JewC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
JewC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop and implement plan to decommission, upgrade or maintain roads to minimize sediment transport to waterways.	2	10	Humboldt County Department of Public Works, Humboldt County RCD, NOAA RC, Private Landowners, RWQCB, USFS	
JewC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
JewC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				

Jewett Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
JewC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with NC steelhead summer flow needs	2	25	CDFW, NMFS, Private Landowners, SWRCB	
JewC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Work with landowners to bypass flow and water conservation during critical low flow periods.	2	25	CDFW, NOAA RC, Private Landowners, SWRCB	
JewC-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
JewC-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
JewC-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks for rural residential users to decrease diversion during periods of low flow.	2	10	NOAA RC, Private Landowners, SWRCB	
JewC-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
JewC-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
JewC-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Humboldt County, Humboldt County, NMFS OLE, SWRCB	
JewC-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	2	25	CDFW, Humboldt County, Humboldt County, NMFS OLE, SWRCB	

Bell Springs Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BSprC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BSprC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
BSprC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	10	CDFW, Mendocino County RCD, NOAA RC, Private Landowners	
BSprC-NCSW-3.1.1.2	Action Step	Hydrology	Develop critical flow values for consideration as a basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the dry season.	1	4	CDFW, NMFS, Private Landowners, SWRCB	
BSprC-NCSW-3.1.1.3	Action Step	Hydrology	Implement a summer water conservation program for rural residential water users that affect tributaries of the mainstem Eel River.	2	10	CDFW, NOAA RC, Private Landowners	
BSprC-NCSW-3.1.1.4	Action Step	Hydrology	Work with law enforcement to reduce or eliminate illegal water diversions.	2	5	CDFW Law Enforcement, NMFS OLE, SWRCB, USFS	
BSprC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BSprC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical barriers to passage				
BSprC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS, NOAA RC, Private Landowners	
BSprC-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	5	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
BSprC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BSprC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pool, LWD, and shelters				
BSprC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Work with agencies to assess habitat and determine beneficial locations lacking in habitat complexity and add instream structure.	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS	
BSprC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions to increase instream shelter, and velocity refuge.	2	10	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
BSprC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BSprC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
BSprC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004)	2	10	CDFW, Mendocino County RCD, NMFS	
BSprC-NCSW-7.1.1.2	Action Step	Riparian	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
BSprC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
BSprC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
BSprC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
BSprC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BSprC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
BSprC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop and implement a plan to decommission, upgrade and maintain roads to minimize sediment transport to waterways.	2	10	Mendocino County Department of Public Works, Mendocino County RCD, NOAA RC, Private Landowners, RWQCB, USFS	
BSprC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
BSprC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				

Bell Springs Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BSprC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with NC steelhead summer flow needs	2	25	CDFW, NMFS, Private Landowners, SWRCB	
BSprC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Work with landowners to bypass flow and conserve water during low flow in the summer and fall.	2	25	CDFW, NOAA RC, Private Landowners, SWRCB	
BSprC-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BSprC-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BSprC-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks for rural residential users to decrease diversion during periods of low flow.	2	10	NOAA RC, Private Landowners, SWRCB	
BSprC-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
BSprC-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BSprC-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	
BSprC-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	2	25	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	

Garcia Creek, Northern California Steelhead (Lower Interior) Threats and Associated Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GaC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GaC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
GaC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	10	CDFW, Mendocino County RCD, NOAA RC, Private Landowners	
GaC-NCSW-3.1.1.2	Action Step	Hydrology	Develop critical flow values for consideration as the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the summer and fall dry seasons.	1	4	CDFW, NMFS, Private Landowners, SWRCB	
GaC-NCSW-3.1.1.3	Action Step	Hydrology	Implement a summer water conservation program for rural residential water users that affect tributaries of the mainstem Eel River.	2	10	CDFW, NOAA RC, Private Landowners	
GaC-NCSW-3.1.1.4	Action Step	Hydrology	Work with law enforcement to reduce or eliminate illegal water diversions.	2	5	CDFW Law Enforcement, NMFS OLE, SWRCB, USFS	
GaC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GaC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical barriers to passage				
GaC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS, NOAA RC, Private Landowners	
GaC-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings.	2	5	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
GaC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GaC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pool, LWD, and shelters				
GaC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Work with agencies to assess habitat and determine beneficial locations lacking in habitat complexity and add instream structure.	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS	
GaC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions to increase instream shelter, and velocity refuge.	2	10	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
GaC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GaC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
GaC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004)	2	10	CDFW, Mendocino County RCD, NMFS	
GaC-NCSW-7.1.1.2	Action Step	Riparian	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
GaC-NCSW-7.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	10	CalFire, CDFW, Mendocino County, Mendocino County RCD, Mendocino Land Trust, NOAA RC, Private Landowners	
GaC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
GaC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
GaC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
GaC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GaC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
GaC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop plan to decommission, upgrade or maintain roads.	2	10	Mendocino County Department of Public Works, Mendocino County RCD, NOAA RC, Private Landowners, RWQCB, USFS	

Garcia Creek, Northern California Steelhead (Lower Interior) Threats and Associated Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GaC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
GaC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GaC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with NC steelhead summer flow needs	2	25	CDFW, NMFS, Private Landowners, SWRCB	
GaC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Work with landowners to bypass flow and conserve water during critical low flow periods.	2	25	CDFW, NOAA RC, Private Landowners, SWRCB	
GaC-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GaC-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GaC-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks for rural residential users to decrease diversion during periods of low stream flow.	2	10	NOAA RC, Private Landowners, SWRCB	
GaC-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
GaC-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GaC-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	
GaC-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	2	25	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	

Soda Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SodC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SodC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
SodC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	20	CDFW, NMFS, Private Landowners	
SodC-NCSW-3.1.1.2	Action Step	Hydrology	Develop critical flow values for consideration as the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the summer and fall dry seasons.	1	4	CDFW, NMFS, Private Landowners, SWRCB	
SodC-NCSW-3.1.1.3	Action Step	Hydrology	Implement a summer water conservation program for rural residential water users that affect tributaries of the main stem Eel River.	2	10	CDFW, NOAA RC, Private Landowners	
SodC-NCSW-3.1.1.4	Action Step	Hydrology	Investigate the potential for landowner to provide summer bypass flow to Welch Creek, a tributary to Soda Creek.	3	1	NMFS, USFS	
SodC-NCSW-3.1.1.5	Action Step	Hydrology	Work with law enforcement to reduce or eliminate illegal water diversions.	2	5	CDFW Law Enforcement, NMFS OLE, SWRCB, USFS	
SodC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SodC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
SodC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW	2	5	CDFW	
SodC-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	5	CDFW, Lake County, NOAA RC, NRCS, Private Landowners, RCD, USFS	
SodC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SodC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
SodC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine beneficial locations and amount of instream structure needed	3	5	CDFW, Lake County, RCD, USFS	
SodC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions to increase instream shelter, and velocity refuge. Focus on stream reaches that provide summer rearing habitat in Soda and Welch creeks.	2	5	CDFW, Lake County, NOAA RC, NRCS, Private Landowners, RCD, USFS	
SodC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SodC-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian condition				
SodC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004)	2	10	CalFire, CDFW, Lake County, Land Trusts, NOAA RC, Private Landowners, RCD	
SodC-NCSW-7.1.1.2	Action Step	Riparian	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
SodC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
SodC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
SodC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Reduce fuel loading through mastication and prescribed burning in the Soda Creek watershed.	2	2	CalFire, USFS	
SodC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
SodC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
SodC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
SodC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SodC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
SodC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	20	CDFW, Lake County, NOAA RC, NMFS, RWQCB, Private Landowners	

Soda Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SodC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Develop and implement plan to decommission or maintain roads to minimize sediment transport to waterways.	2	10	Lake County, NOAA RC, Private Landowners, RCD, RWQCB, USFS	
SodC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
SodC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SodC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with NC steelhead summer flow needs	2	25	CDFW, NMFS, Private Landowners, SWRCB	
SodC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Work with landowners to bypass flow and conserve water during critical low flow periods.	2	25	CDFW, NOAA RC, Private Landowners, SWRCB	
SodC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SodC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SodC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Establish a forbearance program, using water storage tanks for rural residential users to decrease diversion during periods of low flow.	2	10	NOAA RC, Private Landowners, SWRCB	
SodC-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
SodC-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SodC-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	
SodC-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	2	25	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	

Bucknell Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BC-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BC-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
BC-NCSW-3.1.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	10	CDFW, Mendocino County RCD, NOAA RC, Private Landowners	
BC-NCSW-3.1.1.2	Action Step	Hydrology	Develop critical flow values for consideration as the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the dry season.	1	4	CDFW, NMFS, Private Landowners, SWRCB	
BC-NCSW-3.1.1.3	Action Step	Hydrology	Implement a summer water conservation program for rural residential water users that affect tributaries of the mainstem Eel River.	2	10	CDFW, NOAA RC, Private Landowners	
BC-NCSW-3.1.1.4	Action Step	Hydrology	Work with law enforcement to reduce or eliminate illegal water diversions on Bucknell Creek.	2	5	CDFW Law Enforcement, NMFS OLE, SWRCB, USFS	
BC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical barriers to passage				
BC-NCSW-5.1.1.1	Action Step	Passage	Evaluate and prioritize existing list of passage barriers documented by CDFW.	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS, NOAA RC, Private Landowners	
BC-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	5	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	
BC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pool, LWD, and shelter.				
BC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	5	CDFW, Mendocino County, Mendocino County RCD, NMFS, USFS	
BC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement actions to increase instream shelter, and velocity refuge.	2	10	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners, USFS	
BC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
BC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004)	2	10	CalFire, CDFW, Lake County, Mendocino County RCD, Mendocino Land Trust, NMFS, USFS	
BC-NCSW-7.1.1.2	Action Step	Riparian	Work with CalFire and others through the timber harvest permitting process to protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	10	CalFire, CDFW, NMFS, Private Landowners	
BC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
BC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
BC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Reduce fuel loading through mastication and prescribed burning in the Bucknell watershed.	2	2	CalFire, USFS	
BC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
BC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
BC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS	
BC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				

Bucknell Creek, Northern California Steelhead (Lower Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop and implement plan to decommission, upgrade or maintain roads to minimize sediment transport to waterway. Specific road plans should be developed for roads in the Bucknell creek watershed.	2	10	Mendocino County Department of Public Works, Mendocino County RCD, NOAA RC, Private Landowners, RWQCB, USFS	
BC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Work with the USFS to minimize erosion from off-highway vehicle trail system.	2	10	NMFS, USFS	
BC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
BC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Work with landowners to bypass flow and conserve water during critical low flow periods.	2	25	CDFW, NOAA RC, Private Landowners, SWRCB	
BC-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BC-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BC-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Establish a forbearance program, using water storage tanks for rural residential users to decrease diversion during periods of low flow.	2	10	NOAA RC, Private Landowners, SWRCB	
BC-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
BC-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BC-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	
BC-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	2	25	CDFW, Humboldt County, Mendocino County, NMFS OLE, SWRCB	

North-Central Coastal Diversity Stratum

This stratum includes populations of steelhead that spawn in watersheds south of the Lost Coast to Big Salmon Creek (inclusive). The division between this stratum and the one that follows reflects the geometry of and interior characteristics of the larger watersheds along this stretch of coast. The large watersheds in this stratum are more consistently affected by coastal climate, whereas those to the south exhibit a much stronger signature of interior climatic conditions. This division also coincides with one of the moderately pronounced breaks apparent in genetic analyses (Bjorkstedt *et al*. 2005).

The populations that have been selected for recovery are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum, followed by the Rapid Assessment of the Supporting populations:

- Big River
- Caspar Creek
- Noyo River
- Ten Mile River
- Usal Creek
- Wages Creek
- North-Central Coastal Diversity Stratum Rapid Assessment
    - Albion River
    - Cottaneva Creek
    - Pudding Creek

NC steelhead North-Central Coastal Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting.

Diversity Strata	NC winter-run steelhead populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
North-Central Coastal	Albion River	I	Supporting	48.6	6-12	290-581
	Big River	I	Essential	255	20	5,100
	Caspar Creek	D	Essential	12.9	40.4	500
	Cottaneva Creek	I	Supporting	21.9	6-12	129-261
	Noyo River	I	Essential	152.8	21.0	3,200
	Pudding Creek	I	Supporting	23.9	6-12	141-285
	Ten Mile River	I	Essential	171.1	20	3,400
	Usal Creek	I	Essential	27.5	38.4	1,100
	Wages Creek	I	Essential	17.4	39.8	700
	North-Central Coastal Diversity Stratum Recovery Target					**14,000**

NC steelhead North-Central Coastal Diversity Stratum

Big River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Central Coastal
- Spawner Abundance Target: 5,100 adults
- Current Intrinsic Potential: 255 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

In their 1965 analysis of Big River, the California Department of Fish and Game (CDFG) estimated that Big River provided 137 miles of steelhead trout habitat (CDFG 1965). During the same time period, the California Department of Water Resources (1965) estimated the adult spawning abundance of steelhead to be 6,000 fish. Spence *et al.* (2012) estimates the historical size of the Big River population to be 5,100 adult spawners.

Juvenile salmonid distribution has been documented by private timber companies and resource agencies throughout the watershed in the recent past. State agencies and timber company biologists have documented steelhead trout presence in 51 tributaries and the mainstem of Big River. Various survey methods have been used since the 1980s to assess juvenile salmonid distribution. Current surveys using both electrofishing and snorkeling have shown that steelhead distribution remains relatively good throughout the Big River watershed (35 of 51 tributaries). Downie *et al*. (2006) report stocking hatchery fish in Big River and its tributaries with salmonids for over 100 years. Juvenile steelhead were reportedly stocked in James Creek in 1904; and a 1955 CDFG memo describes a depleted CCC coho salmon population and attempts to establish a Chinook salmon run in the 1940s and 1950s .

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, Pomo Indians utilized the Big River fishery resources. Native Americans also used fire in coastal areas to clear land for tribal activities. Starting in 1852, timber harvest began in the lower Big River area with a mill in the town now known as Mendocino. From the beginning of this timber harvesting in the 1850s to about 1940, logs were either driven down stream channels with the use of splash dams or were taken out with the use of railroad cars. In the 1940s, truck transport of logs began with the use of tractor yarding and the construction of roads, skid trails and log landings (GMA 2001). By the 1960s, some harvesting of second growth timber had begun, with poor timber harvesting practices continuing in the 1980s, although the Forest Practice Act (1973) has progressively improved road and yarding systems. The majority of the watershed has been harvested more than once, 79 percent of the acres have been harvested twice, 34 percent has been harvested three times, and eight percent has seen harvesting activities four times (Downie *et al*., 2006).

Roads and railroads associated with timber harvesting have been in the watershed since the 1800s, and in the 1940s railroads were converted to truck roads. Of the 1,242 miles of roads in this basin, 64 percent were built prior to 1979, 32 percent are rocked surface, and less than five percent are paved highways or county roads (Downie *et al*., 2006). Although newer roads tend to generate less surface erosion, USEPA (2001) reports that aerial photo analysis shows that in the last decade roads account for 16 percent of the road surface erosion in the watershed, whereas older roads (1921-1936) account for only one percent of the surface erosion for that period. The sheer number of roads in the watershed today is believed to be the reason for the increased sediment production that currently exists.

Current Resources and Land Management

Due to the remote location and large public ownership of the Big River watershed, a small number of programs and management plans guide land use activities within the basin. Private timber management companies are the largest landowners within the watershed, with Mendocino Redwood Company (MRC) owning 29.4 percent (34,114 acres), Strategic Timber Trust owning 15.4 percent (17,850 acres), and Lyme Redwood Timberlands owning eight percent (9,700 acres) of the watershed. Jackson State Forest accounts for 19.6 percent (22,714 acres) of the watershed, and a new state park, Big River State Park, accounts for 7,342 acres. The majority of the remaining property is owned by 31 property owners (GMA 2001).

Private timberland management varies from maximum sustainable yield on MRC lands to Lyme Redwood Timberlands' goal of sustainable management over time. Jackson Demonstration State Forest management is primarily demonstrating forest management practices, recreation, and environmental conservation.

Salmonid Viability and Watershed Conditions

The following indicators are rated Poor through the CAP process: LWD frequency, shelter rating, primary pools, pool/riffle ratio for juvenile and adult salmonids. Gravel quality for the egg lifestage and stream temperature and canopy cover were rated Poor for summer rearing juveniles. Indicators for watershed processes that are rated Poor through the CAP process include watershed road densities and riparian road densities.

Due to the low abundance of adult steelhead, the population viability attribute is rated as Poor. Juvenile density was rated as Fair across the watershed, and smolt abundance is estimated as Poor at this time.

Recovery strategies will typically focus on ameliorating Poor habitat indicators although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that were rated as Fair through the CAP process, but are considered important within specific areas of the watershed, include gravel quality for eggs, conditions for summer rearing and the estuary, and physical barriers.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Big River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Habitat Complexity: Large Wood and Shelter

Data from the Coastal Watershed Planning Assessment (Downie *et al.*, 2006) show that one of 58 streams meet target values for shelter. Past splash damming and timber harvest activities have reduced large woody debris loading instream reaches across this watershed. Forest canopy has begun to recover with most stream reaches in the watershed approaching or meeting target values, however, current riparian conditions are unlikely to deliver woody debris to provide high quality habitat in the near future. Poor habitat complexity and low LWD volume are expected to limit salmonid rearing and migration habitat by reducing cover and velocity refuge required during freshwater residency.

Water Quality: Temperature

Water temperature in much of the upper mainstem Big River is unsuitable for steelhead rearing during the summer period. Downie *et al.* (2006) report stream temperature conditions in the coastal area tributaries are suitable for salmonid rearing, and the majority of streams in the middle and interior do not meet suitability criteria for juvenile rearing. Based on limited sampling data, tributaries such as Two Log Creek and Beaver Pond Gulch in the middle subbasin area of Big

River have suitable stream temperatures. In the eastern areas of the watershed, the North Fork Big River subwatershed is suitable for salmonid rearing. Also, streams in the South Fork Big River subbasin are suitable for steelhead rearing, with Gates and Montgomery creeks being notable exceptions with very suitable temperature during the summer period (Downie *et al.*, 2006).

Overall, stream temperature for steelhead is rated as Poor due to moderately and unsuitable stream temperatures that occur across the middle and inland portion of the basin. Although canopy targets are being met in many of the stream reaches surveyed, stream temperature monitoring suggests that the level of regeneration of riparian buffers is not yet adequate to fully protect streams.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The majority of stream reaches sampled in Big River do not meet target conditions for pools and the ratio of pools to riffles. Stream reaches with greater than 40 percent pools and 20 percent riffles are considered suitable for salmonid rearing, migration and feeding. Only 21 percent of the streams sampled met the target for primary pool frequency, and no stream reaches met the target for pool/riffle ratio. Streams have low large woody debris loading, which affects pool frequency and increases the amount of flat water, or glide type habitat.

Other Current Conditions

Although substrate condition is rated as Fair for the egg lifestage, there is conflicting information regarding the current condition of instream habitat with respect to fine sediment. Downie *et al*. (2006) report that less than 50 percent of the spawning areas observed in the basin have good embeddedness ratings (low fine sediment in spawning gravel). GMA (2001) suggests that the presence of fine sediment in spawning gravels is currently not limiting fish production. We rated this condition as Fair to indicate that the basin is likely in a state of recovery, yet given the number of roads and slides in the basin there is much work to be implemented to reduce erosion in the watershed. The basin was rated good for adult fish passage; however, there are some barriers caused by culverts at road crossing that need to be addressed for adult steelhead. The estuary is also reported to be in the early stages of recovery from past logging practices (Downie *et al*. 2006) and was rated to be in Fair condition.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Big River CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats particularly when there is a need to address frequent flood and mass wasting events, which will be especially significant in this area due to the steep terrain, high road densities and unstable geology.

Roads and Railroads

Road density was rated as a High threat that, unless abated, will continue to limit fish production in the basin. Although sediment quality is not rated as Poor in the basin currently, roads continue to be the largest source of anthropogenic sediment delivery in the basin (GMA 2001). Road-related slides and surface erosion account for 30 percent of the sediment budget delivered to stream channels, 49 percent of the sediment is from natural processes, and timber harvest activities contribute the remaining 20 percent. GMA (2001) found the recent (1989-1999) spike in road construction has increased sediment yields from surface erosion, while road-related mass wasting and harvest-related surface erosion have decreased.

Severe Weather Patterns

Future impacts of severe weather patterns pose a High threat to watershed processes. The impacts of climate change in this region will have the greatest impact on overall watershed processes that may affect all lifestages by reducing habitat conditions such as pool frequency and increasing fine sediment in spawning areas. Overall, the range and degree of temperature and precipitation variability is likely to increase across all watersheds in California.

Other Threats

Timber harvest and the threat of fire are Medium threats to watershed processes within Big River. Improved forest practices and the implementation of the Mendocino Redwood Company's HCP were the basis for rating timber harvest as a Medium future threat in this watershed. The Mendocino Redwood Company is the largest industrial timberland owner in the watershed. With reduced fire frequency over the last few decades, understory fuel loads have likely increased and have increased the threat of large fires that could increase soil destabilization and future erosion. However, because of the current fire suppression capability available, this threat rates as a Medium future threat. Although channelization from past splash damming continues to affect current instream habitat quality, it has not been conducted for decades and is not a future threat.

Limiting Stresses, Lifestages, and Habitats

Based on the type and extent of stresses and threats affecting the population as well as the limiting factors influencing productivity, summer and winter rearing habitat for the juvenile lifestage is most limited. The egg lifestage is likely limited by elevated fine sediment that reduces survival to emergence in many spawning areas across the watersheds.

General Recovery Strategy

Habitat Complexity: Large Wood and Shelter

Restoration actions should focus on improving large woody debris (LWD) frequency across the watershed and the estuary. Riparian areas are in the process of recovery with stands of smaller diameter conifers that currently buffer stream areas. Adding LWD will provide much needed complexity to stream channels until riparian areas reach maturity and begin to recruit LWD naturally to channels. Stream reaches with improved or restored LWD will provide important refuge from high flow events and for increased habitat availability for juvenile steelhead throughout their freshwater residency. Increased LWD loading is also expected to improve sediment routing by sorting gravels and improving spawning habitat quality.

The estuary has been identified as an important refugia area for rearing and smolt lifestages of salmonids (Downie *et al.* 2006), therefore we recommend assessing the potential for improving complexity within this habitat area.

Improve Stream Temperatures

The approach to improving riparian conditions in the basin will need to focus on minimizing further riparian vegetation loss and rehabilitating riparian areas that are currently in poor or fair condition, which primarily occur in the inland subbasins of this watershed. As discussed above, recovering riparian function will improve LWD recruitment, but also is expected to improve summer stream temperatures.

Improve Habitat and Substrate Quality

Reducing sediment delivery from roads and timber harvest is expected to improve a number of key attributes for salmonids in Big River. Slides and surface erosion resulting from road failures and timber harvest currently account for approximately 50 percent of the sediment budget in the watershed. The inland subbasins tend to have steeper slopes and a higher number and volume of slides than coastal and middle areas of the watershed. Reducing management-related sediment delivery from roads and mass wasting to stream channels is expected to improve gravel quality, egg survival, benthic macro-invertebrate production, and pool volume.

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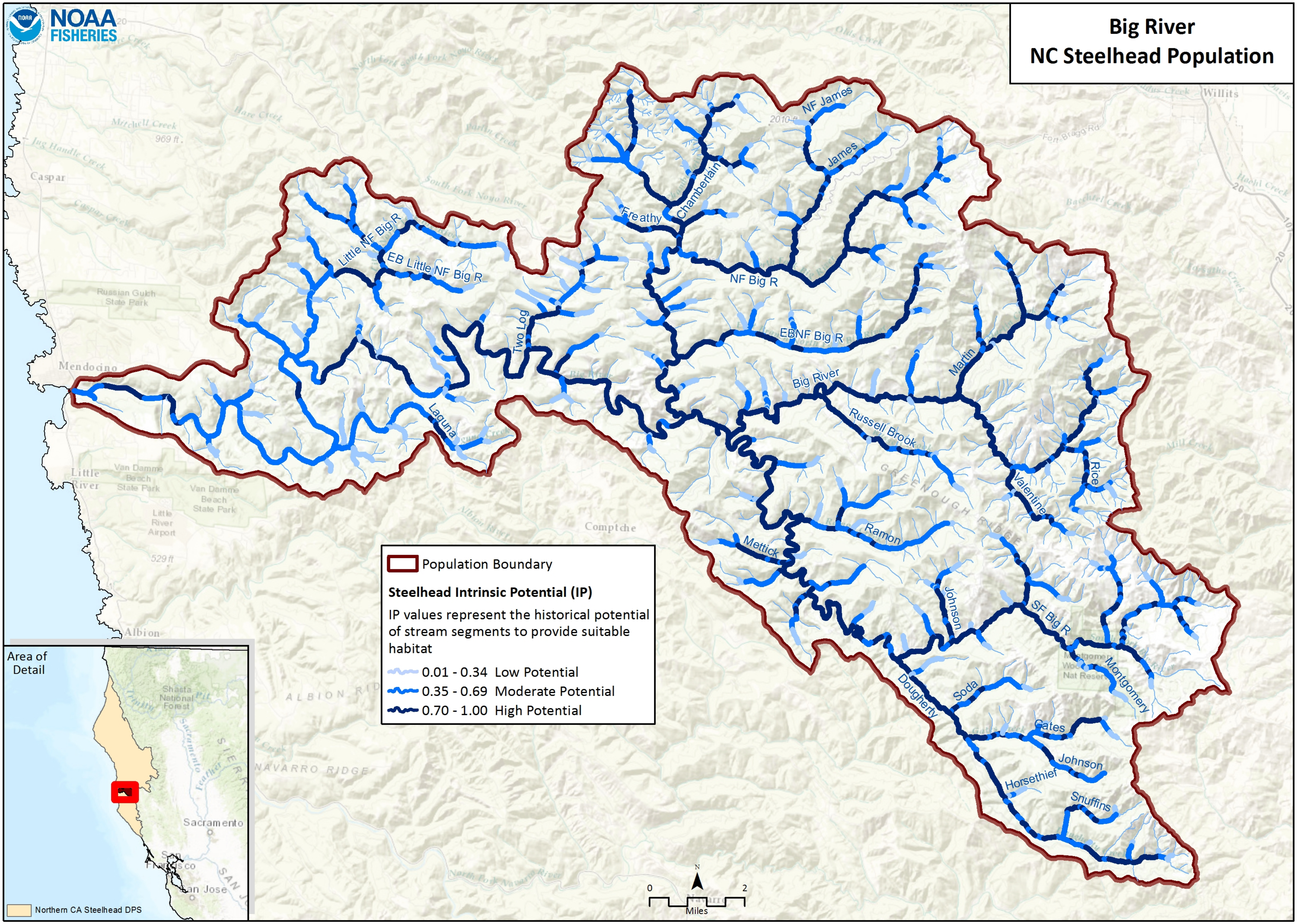

NOAA FISHERIES
Big River
NC Steelhead Population
NF James
James
Chamberlain
Freathy
Little NF Big R
EB Little NF Big R
NF Big R
EBNF Big R
Two Log
Big River
Martin
Laguna
Russell Brook
Rice
Valentine
Ramon
Mettick
Johnson
SF Big R
Montgomery
Dougherty
Soda
Gates
Johnson
Horsethief
Snuffins
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
Sacramento
0
2
Miles
N

NC Steelhead Big River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams meet target. Current PRF ratio 30:21:43	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	> 75% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 75	Fair
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	46% of streams/ IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	21% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 75	Fair

						Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
				Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.03 Diversions/10 IP-km	Good
				Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
				Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>98% of IP-km	Good
				Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
				Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
				Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
				Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
				Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-km maintains severity score of 3 or lower	Very Good
			Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2-0.6 Fish/m^2	Fair
				Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good

4	Winter Rearing Juveniles	Condition	Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.49% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair

			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.03 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		31,300-630,000 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<1% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	6.3 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	8.7 Miles/Square Mile	Poor

NC Steelhead Big River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture							
2	Channel Modification	Low	Low	Medium	Medium	Low	Medium	Medium
3	Disease, Predation and Competition							
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Medium	Low
5	Fishing and Collecting	Medium		Low				Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching							
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Low	Medium	Medium
9	Mining							
10	Recreational Areas and Activities	Low	Low					Low
11	Residential and Commercial Development							
12	Roads and Railroads	Low	Medium	Medium	Low	Low	High	Medium
13	Severe Weather Patterns	Low	Medium	Medium		Low	High	Medium
14	Water Diversion and Impoundments	Low		Medium			Low	Low

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
BigR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	CDFW, MMWD, SPAWN	
BigR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	3	10	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, State Parks	
BigR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited	Initial projects should target stream reaches with high IP-km values, however, consideration should be also given to mainstem Big River, particularly mainstem reaches above the estuary.
BigR-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, and use streamway concept where appropriate.	2	25	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited	
BigR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
BigR-NCSW-5.1.1.1	Action Step	Passage	Modify two barriers on James Creek. One barrier is one-half mile from the mouth of James Creek and is a bedrock cascade that needs modification for adult steelhead passage. The second barrier is on the North Fork of James Creek and is located where Highway 20 encroaches on the stream channel and has created a barrier.	1	5	CDFW, Jackson Demonstration State Forest, NMFS	
BigR-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	20	CDFW, Jackson Demonstration State Forest, NMFS	
BigR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
BigR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historic salmonid habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	10	California Coastal Conservancy, CDFW, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks	These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority.
BigR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Fund a watershed coordinator.	2	10	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, RCD, RWQCB, State Parks, Trout Unlimited	Currently, Big River is managed by five or six larger landowners - including State, private, and non-profit. A coordinator is likely necessary to focus actions and resources in key areas and to apply for grants that will span multiple landowners.
BigR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Install properly sized large woody debris to meet targets specified in recovery plan.	2	20	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, UC Extension	Much of Big River has been habitat typed and thus the stream reaches lacking wood can be readily identified. Permitting should be streamlined because of programmatic biological opinions for these types of actions.
BigR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CalFire, CDFW, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Encourage the development and implementation of large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).	2	20	CalFire, CDFW, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks	
BigR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)				
BigR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Increase primary pool frequency to more than 40 percent, and riffle frequency to more than 30 percent in at least 75% of the stream.	2	20	CDFW, NMFS, NOAA RC, Lyme Timber, Private Landowners	
BigR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
BigR-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	20	CDFW, Coastal Ridges, Conservation Fund, Mendocino Redwood Company, Private Landowners, Redwood Forest Foundation, State Parks, The Nature Conservancy	
BigR-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, CalTrans, Conservation Fund, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RWQCB, State Parks	Particular attention should be directed at implementing this action along mainstem Big River. Mainstem temperatures are very warm, particularly in the lower reaches, and it will take a considerable time to grow the riparian canopy to sufficient size to add in overall stream shading.
BigR-NCSW-7.1.1.3	Action Step	Riparian	Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs to the North and South Forks Big River, mainstem Big River, and Daugherty Creek.	2	20	CalFire, Private Landowners	
BigR-NCSW-7.1.1.4	Action Step	Riparian	Develop riparian improvement projects along James Creek to increase canopy levels.	2	20	CDFW, Jackson Demonstration State Forest, NOAA RC, Trout Unlimited	Recommendation from CDFW coastal watershed report.
BigR-NCSW-7.1.1.5	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	20	Jackson Demonstration State Forest, Mendocino Redwood Company, Timber Companies	
BigR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality and distribution for macro-invertebrate productivity (food)				
BigR-NCSW-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	5	CalFire, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USEPA	This sediment reduction plan could be part of a larger road and sediment reduction plan. This plan should tier off recommendations in the Big River TMDL.
BigR-NCSW-8.1.1.2	Action Step	Sediment	Treat high priority slides and landings identified in credible landowner assessments. Focus efforts in the South Daugherty and Chamberlain Creek subbasins.	2	10	CDFW, NOAA RC, Private Landowners, Trout Unlimited	A sediment assessment will identify high priority slides and landings.
BigR-NCSW-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino County Department of Public Works, RWQCB, State Parks	This infrastructure is likely present in much of the Big River subwatersheds.
BigR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
BigR-NCSW-10.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient. Focus on tributaries in the Middle and Inland subbasins that do not meet canopy target of 70 percent. Use CDFW habitat typing data/reports to determine tributaries that do not meet canopy target.	2	10	CDFW, Mendocino Redwood Company, Private Landowners, RCD, Trout Unlimited	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
BigR-NCSW-11.1.1.1	Action Step	Viability	Measure or estimate the condition of key habitat attributes across the watershed. Prioritize tributaries that have been habitat typed in the past.	2	5	CDFW, Lyme Timber, NMFS	
BigR-NCSW-11.1.1.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFW habitat assessment protocols) to ensure ESU-wide consistency.	3	60	CalFire, California Department of Mines and Geology, CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RPFs, RWQCB, SWRCB, UC Extension	Most of the watershed has been habitat typed according to CDFW stream protocols.
BigR-NCSW-11.1.1.3	Action Step	Viability	Monitor population status for response to recovery actions.	2	10	CDFW, NMFS, Jackson State Demonstration Forest	
BigR-NCSW-11.1.1.4	Action Step	Viability	Conduct monitoring activities to determine the abundance of adult and smolt salmonids in Big River.	2	12	CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, State Parks	
BigR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
BigR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
BigR-NCSW-19.1.1.1	Action Step	Logging	Establish greater oversight for pre and post-harvest monitoring by the permitting agency for operations.	3	5	CalFire, CDFW, NMFS	
BigR-NCSW-19.1.1.2	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas.	2	20	NMFS	
BigR-NCSW-19.1.1.3	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	10	CalFire, CDFW, NMFS	
BigR-NCSW-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	10	County, CDFW, NMFS, RCD	
BigR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BigR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	This plan should leverage the Big River TMDL.
BigR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Continue efforts such as road improvements, and decommissioning to reduce sediment delivery to Big River and its tributaries. CDFW stream surveys indicated Kidwell Gulch, Two Log Creek, and Saurkraut Creek have road sediment inventory and control as a top tier tributary improvement recommendation.	3	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	
BigR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	
BigR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized users to decrease fine sediment loads.	3		CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 2015).	3	100	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	
BigR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	10	NMFS, CDFW, CalFire, Caltrans	
BigR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
BigR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting that could impact steelhead. These agencies should use existing regulations or other mechanisms to minimize water use during the summer months.	2	20	CDFW, CDFW Law Enforcement, Mendocino County, NMFS OLE, NOAA RC, Private Landowners, SWRCB	
BigR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Develop critical flow values to be considered as the basis for minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months. Focus stream gaging efforts on the South Fork Big River.	2	5	CDFW, NMFS, SWRCB	Initial efforts should be focused in upper South Fork Big River where numerous small landowners are believed to divert from Big River for domestic purposes.
BigR-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for steelhead, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	2	60	CDFW, NMFS, Private Landowners, SWRCB	Stream flow modeling will determine critical low flow levels (above action step). Conservation programs are contingent upon water users participation and feasibility of water conservation practices.
BigR-NCSW-24.1.1.4	Action Step	Severe Weather Patterns	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., frequent flooding, extreme low flow conditions (drought), sea level rise, etc.).	2	10	NMFS, County	
BigR-NCSW-24.2	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species' continued existence**				
BigR-NCSW-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-24.2.1.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	20	NMFS, CDFW, CalFire, County	
BigR-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
BigR-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFW, CDFW Law Enforcement, NMFS OLE, Private Landowners, SWRCB	
BigR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Improve coordination between agencies and others to address the season of water diversions, off-stream reservoirs, and bypass flows to better protect steelhead and their habitats (CDFG 2004).	2	10	CDFW, NMFS, Private Landowners, SWRCB, USFWS	
BigR-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	60	NMFS, NMFS OLE, Private Landowners, SWRCB	
BigR-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	2	2	CDFW, NMFS, SWRCB	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-25.1.1.5	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	2	10	SWRCB	
BigR-NCSW-25.1.1.6	Action Step	Water Diversion/ Impoundment	Install streamflow gauging devices to determine the current streamflow condition.	2	10	NMFS, SWRCB, USGS	This information could provide baseline information that would be useful in evaluating changes to baseflow over time.
BigR-NCSW-25.1.1.7	Action Step	Water Diversion/ Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	5	CDFW, NMFS, SWRCB, NOAA RC	
BigR-NCSW-25.1.1.8	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, NMFS, SWRCB, NOAA RC	
BigR-NCSW-25.1.1.9	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).□	2	5	CDFW, NMFS, SWRCB, NOAA RC	
BigR-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	1	10	NOAA RC, Private Landowners, RCD, SWRCB	Focus on Landowners in the South Fork Big River subbasin.
BigR-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential salmonid streams (CDFG 2004).	2	5	CDFW, NMFS, SWRCB,	

Caspar Creek Population

NC Steelhead Winter-Run

- Role within DPS: Dependent Population
- Diversity Stratum: North Central Coastal
- Spawner Abundance Target: 500 adults
- Current Intrinsic Potential: 12.9 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The first known estimate of steelhead abundance in Caspar Creek occurred in 1957 (CDFG 1957) when CDFW staff observed 15-20 juvenile (ranging in size from 1.3 inches to 5 inches) in large pools. The ratio of steelhead to coho salmon was 60-70 percent steelhead to 30-40 percent coho salmon. In the 1960-61 season, Kabel and German (1967 as cited in Gallagher and Wright 2008) counted coho salmon and steelhead entering Caspar Creek at a mill pond fish ladder (located near the mouth of Caspar Creek and which was removed in summer 1961). Although not clearly stated in the Kabel and German (1967 as cited in Gallagher and Wright 2008) report; assuming all fish were counted at this ladder, there were a total of 92 adult steelhead in Caspar Creek in 1960-61. The next estimates consisted of juvenile density by CDFG (1965) staff who documented a density of approximately 20 juvenile steelhead per one hundred feet. Density estimates using seines indicated approximately 2/3rds of the salmonids were coho salmon and 1/3 were steelhead (CDFG 1965).

Burns (1972) evaluated impacts of logging and road building on juvenile salmonid abundance in four northern California streams from 1966 through 1969, including Caspar Creek. Prior to logging and road building on South Fork Caspar Creek in June 1967, the estimated population of *O. mykiss* was 10,183 young-of-year and 673 one year or older fish. Following road building, the population had declined to 1,436 young-of-year and 106 one year or older fish (these declines are not unexpected as the population typically declines over summer due to competition for resources and predation). However, conditions in South Fork Caspar had deteriorated following pre-Forest Practice Rules logging and road construction, and in October 1968 the number of one-year plus fish had declined to 51 fish and increased to 141 in October of 1969.

The Salmon Trollers Marketing Association (STMA) (Maahs 1997) and CDFW estimated adult coho salmon abundance in Caspar Creek in the late 1980s through the 1990s (Maahs 1997). In their abundance surveys, the presence of adult steelhead were also recorded but are considered observational only and not an accurate population estimate due to the sampling methods used by the STMA. Between the winters of 1989/1990 and 1996/1997 combined totals of peak live counts/carcasses ranged from two adult steelhead in 1991/1992 to a high of 13 in 1990/1991. Maahs (1997) noted NC steelhead were less likely to be observed in Caspar Creek due to the short length of the creek, which would allow adults to more quickly enter the watershed, spawn, and return to the ocean than other streams included in their study which suggests the population may have been larger than observed.

In 2004/2005, CDFW initiated sampling in the Caspar Creek watershed, according to criteria in an action plan for monitoring California's coastal salmonid populations (Boydstun and McDonald 2005). Under this monitoring scheme, Caspar Creek and two other local streams serve as life cycle monitoring streams to calibrate regional sampling consisting of extensive spawning surveys to estimate escapement. The sampling is based on redd counts selected under a random stratified survey of ten percent of available habitat each year. In streams that serve as the life cycle stations, abundance of adults and smolts is estimated and a complete census of redd density is conducted (Gallagher and Wright 2009). The 2008/2009 basin-wide estimate of spawning abundance was estimated at seven adults (Gallagher and Wright 2009) and the estimate of average redd abundance was less than 2.5 per kilometer. Estimates of smolt abundance for 2007/2008 was 2,045, and for 2008/2009 estimated abundance was 1,885.

History of Land Use

Caspar Creek drains approximately eight square miles of the California Coast Range in western Mendocino County, entering the Pacific Ocean near the town of Caspar. The first European settlement in the area occurred before the 1860s. In 1860 the Caspar Lumber Company was formed, and logging began in the watershed with a sawmill built at the mouth of Caspar Creek. Clearcut logging was used and logs were dragged down to the watercourses. Three log crib dams were constructed to provide additional discharge for river log drives down to the sawmill, and it is estimated that two log drives per winter took place in each of the North and South Fork drainages. By the late 1890s the entire watershed had been harvested and timber management did not begin again until the early 1960s (primarily excerpted from Ziemer 1998).

Jackson Demonstration State Forest was formed in 1947, when the State of California bought the Caspar Lumber Company which included the majority of the Caspar Creek watershed. In 1962, the Caspar Creek Watershed Study was initiated to obtain more information on the effects of logging and road construction on sedimentation and aquatic habitat. The study is a cooperative effort between CalFire and the Pacific Southwest Reach Station Redwood Sciences Laboratory. The study has been conducted in two phases. The South Fork phase was designed as a traditional paired-watershed study and involved monitoring the impacts of road construction and selection harvesting by tractor on streamflow, suspended sediment, and bedload. The North Fork phase was started in the early 1980s and harvest units were logged using primarily skyline cable yarding techniques. Road and landing construction and tractor logging were limited to ridgetop and upper slope locations during the North Fork phase.

Current Resources and Land Management

The primary resource and land management practices continue to be timber harvest. Most of the timber management is part of the Caspar Creek Watershed Study which includes ongoing research on the effects of timber harvest to various watershed processes, including flooding and stormflows, erosion and suspended sediment transport, water quality and nutrient cycling, aquatic organisms, and drainage processes. Within the last 12 years, only about two percent of the watershed has been under a timber harvest plan. Only about 10 percent of the watershed is in private ownership, with a small portion of the watershed consisting of rural residential homes (about 40 housing units are present) that are primarily located on the ridge tops. The Caspar estuary is located at Caspar beach, which is visited by numerous swimmers and sunbathers.

Salmonid Viability and Watershed Conditions

The following habitat attributes are rated Poor through the CAP process: habitat complexity, sediment transport, hydrology, and water quality. Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the upper watershed.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Casper Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Sediment Transport: Road Density

Excessive rates of sediment transport in the Caspar watershed have compromised spawning and rearing habitat. Pool filling appears to be occurring from sediment transport from upslope sources. Sources that contributed to the altered sediment transport are most likely due to existing roads and associated maintenance.

Habitat Complexity: Large Wood and Shelter

According to Stillwater Sciences *et al.* (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. Therefore, LWD is an even more critical habitat element than in more northern streams to form pools or areas of refuge from high flows. Despite LWD ratings for Caspar being rated as Very Good, only 33 of the instream shelter values measured (five percent of the total IP) >80 and shelter values were rated as Poor in the CAP evaluation. This suggests instream shelter is compromised, possibly due to channel incision that may be a function of historical logging practices and historical log drives during the first logging entry. To improve shelter rating, LWD input should be evaluated in specific stream reaches where improvements are anticipated to result in benefits such as reaches with softer banks, and reaches where LWD is rated below Very Good. Focusing on actions to improve instream gravel retention would ultimately work to increase stream bed elevation and floodplain connectivity.

Other Current Conditions

Overall, the Caspar watershed is subject to fewer conditions than many other watersheds in the steelhead DPS due to a singular land use (timber harvest) and a lack of urban or rural residential impacts.

Threats

The following discussion focuses on those threats that are rated as High or Very High (see Caspar Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address threats rated as Low when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Caspar Creek CAP Results.

Disease Predation and Competition

Disease, predation and competition are rated as a High threat to smolts due to the low abundance of this lifestage in the watershed and their risk for predation. Reduced abundance may occur as a result of avian (*e.g.*, gulls and mergansers) and mammal predation (Spence *et al.* 1996). This threat is likely increased due to a lack of sufficient escape cover (undercut banks and entrenched stream reaches).

Logging and Wood Harvesting

Timber harvest remains a threat to steelhead habitat in the Caspar Creek, but at diminished levels compared to historical practices. For steelhead, timber harvest was listed as a threat to watershed processes due primarily to road use, road location and density, and the resulting increases in sediment input. Nonetheless, the Caspar Creek watershed is unique in that it is a very well-studied watershed and timber harvest plans receive a high degree of scrutiny and oversight, which may ameliorate impacts compared to timber operations in other watersheds.

Roads and Railroads

Road densities are high throughout the watershed, estimated at 4.9 miles of road per square mile of watershed area and at 5.7 miles per square mile of riparian area. Roads parallel many of the waterways within Caspar Creek and impinge on channel migration. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook indicates all lifestages are impaired in the Caspar watershed with summer rearing being the most stressed. Water quantity is likely the most significant limiting habitat attribute and residential development and the associated impacts of development are the most significant threats into the future.

General Recovery Strategy

Habitat Complexity: Large Wood and Shelter and Sediment: Gravel Quality and Distribution of Spawning Gravels

Recovery actions should focus on retaining instream LWD to improve floodplain connectivity through placement of standard log/boulder habitat structures which can effectively increase holding and rearing habitat and retain instream gravels. Since virtually no infrastructure is present in downstream areas, properly sized trees could be felled into stream channels to create these structures. Retention of instream gravels could ultimately increase bed elevation and enhance stream channel interactions with floodplain areas.[1]

Winter habitat LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods. Summer habitat LWD projects should be implemented and designed to provide cover for improved shelter, and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions.

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[1] Floodplains have incised and it is likely, based on this incision, that undercut banks and other cover/shelter analogs are significantly less functional than under historical conditions. Based on these criteria, high velocity refugia are considered marginal.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall or flooding events.

Investigate and Address Impairment to Caspar Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Lost Coast Diversity Stratum. Restoration actions should address habitat availability and suitability. However, the current function of this small estuary for providing suitable juvenile rearing conditions is unknown. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the habitat potential of the estuary to provide necessary attributes for salmonid survival should occur.

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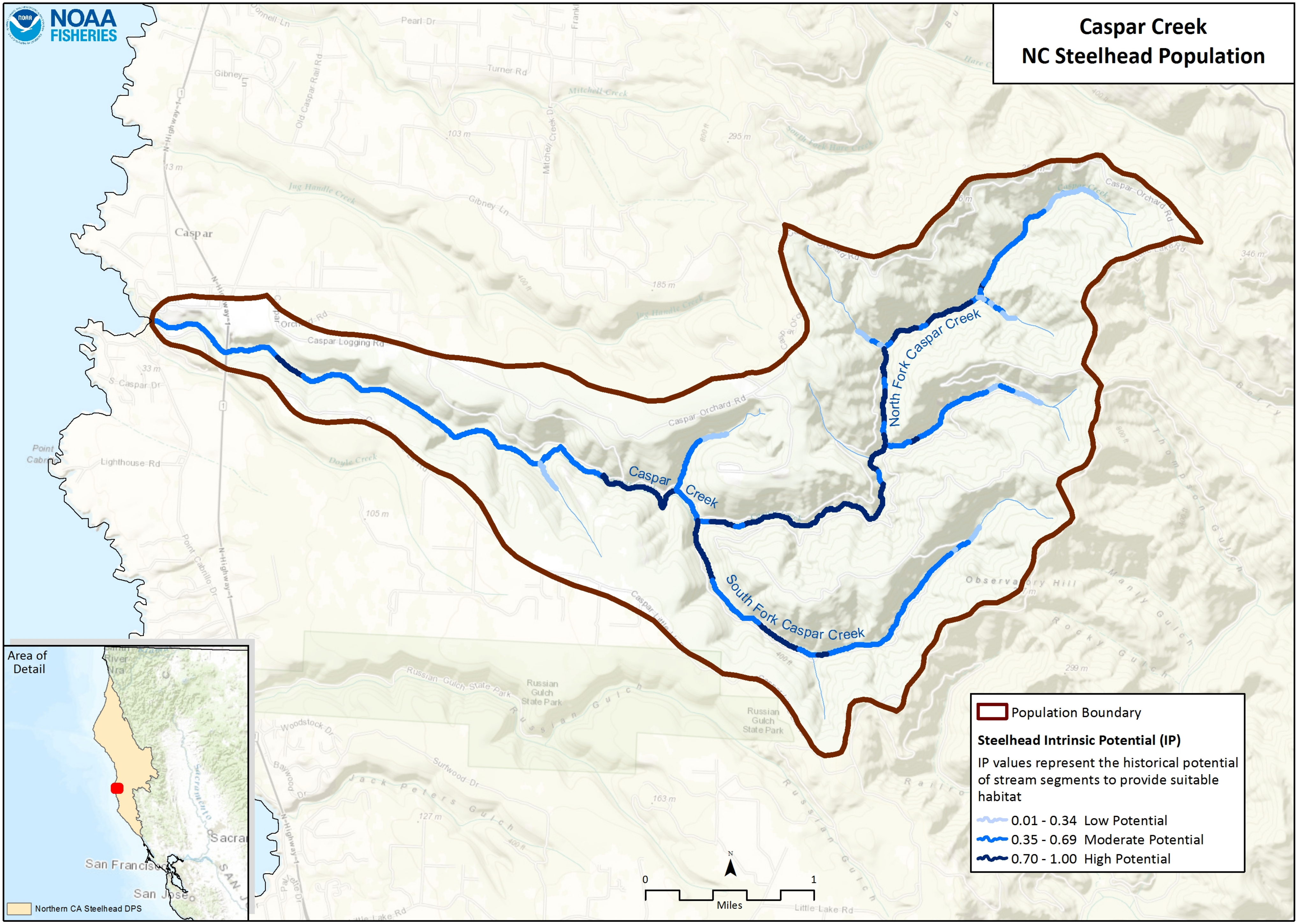

NOAA FISHERIES
Caspar Creek
NC Steelhead Population
Caspar Creek
North Fork Caspar Creek
South Fork Caspar Creek
Area of Detail
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles

NC Steelhead Caspar Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Very Good
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	67% streams/ 95% IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	56% Class 5 & 6 across IP-km	Good
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Very Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	33% streams/ 24% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	67% streams/ 95% IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP km	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	100% streams/ 100% IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	56% Class 5 & 6 across IP-km	Good
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.7 - 1.5 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Very Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	67% streams/ 95% IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	56% Class 5 & 6 across IP-km	Good
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		2045 in 2009 = Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.233% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	2% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	7% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	4.9 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.7 Miles/Square Mile	Poor

NC Steelhead Caspar Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Medium	Low	Medium
2	Channel Modification	Low	Low	Medium	Low	Low	Medium	Medium
3	Disease, Predation and Competition	Medium	Low	Medium	Low	High	Low	Medium
4	Hatcheries and Aquaculture							
5	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Medium	Medium
6	Fishing and Collecting	Medium		Low		Medium		Medium
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Medium	High	Medium
9	Mining							
10	Recreational Areas and Activities	Low	Low	Medium	Medium	Low	Medium	Medium
11	Residential and Commercial Development	Low	Low	Medium	Medium	Low	Medium	Medium
12	Roads and Railroads	Medium	High	High	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Medium	Medium

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
CaC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate enhancement opportunities for the Caspar estuary.	3	5	California Coastal Conservancy, CDFW, County of Mendocino, Jackson Demonstration State Forest, NMFS, USFS	Evaluation should include analysis of the historical tidal prism vs the current prism of the estuary. Breaching, if it occurs, should also be evaluated and a series of recommendations (in necessary) should be proposed. Careful consideration should be given to preservation of historical foundations of the Caspar Saw Mill which is located in the estuary.
CaC-NCSW-1.1.1.2	Action Step	Estuary	Evaluate juvenile salmonid usage of the Caspar estuary during the summer and late fall period.	3	3	CDFW, Jackson Demonstration State Forest, NMFS, USFS	Steelhead utilization of the Caspar estuary during the summer/late fall is unknown. Lagoons are documented to be important rearing habitats for juvenile steelhead and it is possible the Caspar lagoon may serve a similar role as documented by researchers in other central California lagoons. If steelhead utilization is limited, measures to improve the overall productivity of this habitat feature should be evaluated and enhancement measures proposed.
CaC-NCSW-1.1.1.3	Action Step	Estuary	Evaluate water quality conditions in the estuary.	3	2	CDFW, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
CaC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	5	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	5	CalFire, California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, USFS	Floodplains have incised and it is likely, based on this incision, that undercut banks and other cover/shelter analogs are significantly less functional than under historical conditions. Based on these criteria high velocity refugia are considered marginal. Increased LWD frequencies may provide the winter habitat targeted by this action.
CaC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	2	10	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.	2	10	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1.1.5	Action Step	Floodplain Connectivity	Existing areas with floodplains or off channel habitats should be protected from future urban development to the maximum extent practicable.	3	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, USFS	Avoiding development in existing or historical floodplains on Caspar may result in significant benefits to overwinter survival. No additional development, particularly roads, should occur here so as to avoid precluding future restoration actions.
CaC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				
CaC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	100	CalFire, CDFW, Jackson Demonstration State Forest, USFS	

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CalFire, CDFW, Jackson Demonstration State Forest, USFS	These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity and shelter values in potential rearing and migration reaches. Some large woody debris supplementation has already occurred in the watershed.
CaC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility.	2	10	CalFire, CDFW, Jackson Demonstration State Forest, USFS	
CaC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Work with Jackson Demonstration State Forest and USFS staff to implement projects that improve instream shelters.	2	20	CalFire, CDFW, Jackson Demonstration State Forest, USFS	
CaC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
CaC-NCSW-8.1.1	Recovery Action	Sediment	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CaC-NCSW-8.1.1.1	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS, Private Landowners, RPFs, RWQCB, USFS	
CaC-NCSW-8.1.1.2	Action Step	Sediment	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	2	100	CalFire, CDFW, Mendocino County, NMFS, RWQCB	
CaC-NCSW-8.1.1.3	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	20	CalFire, Jackson Demonstration State Forest, Lyme Timberland, RWQCB, USFS	
CaC-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream water quality conditions				
CaC-NCSW-10.1.1.1	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	50	CalFire, CDFW, NMFS, NOAA RC, RCD, County	
CaC-NCSW-10.1.1.2	Action Step	Water Quality	Identify and remediate sources of chronic and episodic sediment contribution to the Caspar Creek watershed.	3	100	CalFire, California Department of Mines and Geology, CalTrans, Jackson Demonstration State Forest, Lyme Timberland, USFS	Caspar Creek is heavily monitored through the USFS long term monitoring program. Sources of sediment from roads and landslides resulting from ongoing land management activities should be corrected as soon as feasible to improve over winter survival of juvenile salmonids. This is a broad recommendation and could include major actions such as road reconstruction, decommissioning and landslide stabilization. Conversely, relatively small actions may yield large benefits.
CaC-NCSW-10.1.1.3	Action Step	Water Quality	Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.	3	10	CalFire, Jackson Demonstration State Forest, USFS	Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall or flooding events.
CaC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
CaC-NCSW-11.1.1.1	Action Step	Viability	Continue ongoing adult and smolt sampling efforts in the watershed. Establish consistent reporting methods to ensure DPS-wide consistency.	1	20	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners, USFS	
CaC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CaC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	25	NMFS, CDFW, CalFire	
CaC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts,USFS, and regulatory agencies with expertise in fisheries issues.	3	30	NMFS, CDFW, CalFire, USFS, County	
CaC-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Disseminate plan to all local fire fighting agencies.	2	3	CalFire, Lyme Timberland, USFS	
CaC-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing fire fighting assistance in the Caspar Creek watershed (and all other watersheds in the County).	2	100	CalFire, Jackson Demonstration State Forest	
CaC-NCSW-15.1.1.5	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by fire fighting actions.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, NMFS, USFS, USFWS	
CaC-NCSW-15.1.1.6	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while fire fighters and fire fighting equipment are on site.	2	100	CalFire, County of Mendocino, Lyme Timberland, USFS	Sediment control is a requirement for all post fire fighting actions. Immediately implementing these measures (when feasible) when equipment and crews are available will minimize mobilization costs and result in a long term cost savings.
CaC-NCSW-15.1.1.7	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	100	CalFire, County of Mendocino	Action is considered In-Kind
CaC-NCSW-15.1.1.8	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	Action is considered In-Kind
CaC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
CaC-NCSW-19.1.1.1	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Jackson Demonstration State Forest, Private Landowners, USFS	Cost based on treating 1 mile (assume 80 acres/mile in 15% High IP with a minimum of 1 mile) at a rate of $1,400/acre.
CaC-NCSW-19.1.1.2	Action Step	Logging	Encourage Jackson Demonstration State Forest and USFS to implement restoration projects as part of their ongoing practices in priority stream reaches and where LWD is found lacking.	2	30	CalFire, CDFW, Jackson Demonstration State Forest, USFS	Recovery actions should focus on retaining instream LWD to improve floodplain connectivity through placement of standard log/boulder habitat structures which can effectively increase holding and rearing habitat and retain instream gravels. Since virtually no infrastructure is present in downstream areas, properly sized trees could be felled into stream channels to create these structures. Retention of instream gravels could ultimately increase bed elevation and enhance stream channel interactions with floodplain areas.
CaC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-19.1.2.1	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	Jackson Demonstration State Forest, Lyme Timberland, Private Landowners, USFS	
CaC-NCSW-19.1.2.2	Action Step	Logging	Implement the Jackson Demonstration State Forest Road Management Plan.	3	100	CalFire, Jackson Demonstration State Forest, USFS	Implementation of the plan for all future harvest should reduce additional sediment input.
CaC-NCSW-19.1.2.3	Action Step	Logging	Establish equipment limitation zones on headwater streams and swales.	2	100	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners, RPFs, RWQCB	
CaC-NCSW-19.1.2.4	Action Step	Logging	Use aerial yarding systems rather than ground-based yarding methods.	2	100	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners	
CaC-NCSW-19.1.2.5	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	3	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, RWQCB, USFS	Timber management is the primary landuse in the watershed and this recommendation is a standard business practice. This recommendation is more likely to be implemented due to the research role that Caspar serves for the USFS and Calfire.
CaC-NCSW-19.1.2.6	Action Step	Logging	Protect headwater channels to minimize anthropogenic fine sediment sources.	2	25	CalFire, Jackson Demonstration State Forest, Lyme Timberland, RWQCB, USFS	
CaC-NCSW-19.1.2.7	Action Step	Logging	See Roads recommendations for additional actions to reduce sediment impacts.				
CaC-NCSW-19.1.2.8	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS, Private Landowners	
CaC-NCSW-19.1.2.9	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	20	CalFire, CDFW, Jackson Demonstration State Forest, NMFS, USFS	
CaC-NCSW-19.1.2.10	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Jackson Demonstration State Forest, USFS	Timber harvest remains a threat to salmonid habitat in the Caspar Creek, but at diminished levels compared to historical practices. For steelhead, timber harvest was listed as a threat to watershed processes due primarily to road use, road location and density, and the resulting increases in sediment input. Nonetheless, the Caspar Creek watershed is unique in that it is a very well-studied watershed and timber harvest plans receive a high degree of scrutiny and oversight, which may ameliorate impacts compared to timber operations in other watersheds.
CaC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
CaC-NCSW-19.1.3.1	Action Step	Logging	Manage timberlands to establish a diverse forest environment exhibiting properly functioning instream habitat, and implement restoration actions where degraded habitat is limiting salmonid production.	3	100	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-19.1.3.2	Action Step	Logging	Reduce the amount and rate of even aged management.	2	50	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners	Changing silviculture practices to uneven age management will likely reduce channel bank erosion and channel incision. Research has found a linkage between increased peak flows associated with clearcut harvesting in small headwater basins and increased sediment yields due to channel expansion.
CaC-NCSW-19.1.3.3	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-19.1.3.4	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-19.1.3.5	Action Step	Logging	Encourage Jackson Demonstration State Forest and USFS to implement restoration projects as part of their ongoing practices in priority stream reaches and where LWD is found lacking.	2	20	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS	We encourage JDSF to initiate an unanchored LWD recruitment program. Engineered structures may be determined to be necessary above the existing weirs used by the USFS for their long term monitoring project.
CaC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
CaC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
CaC-NCSW-19.2.1.1	Action Step	Logging	Reduce the amount and rate of even aged management.	2	100	CalFire, Jackson Demonstration State Forest, USFS	In 1962, the Caspar Creek Watershed Study was initiated to obtain more information on the effects of logging and road construction on sedimentation and aquatic habitat. The study is a cooperative effort between CalFire and the Pacific Southwest Reach Station Redwood Sciences Laboratory. The study has been conducted in two phases. The South Fork phase was designed as a traditional paired-watershed study and involved monitoring the impacts of road construction and selection harvesting by tractor on stream flow, suspended sediment, and bedload. The North Fork phase was started in the early 1980s and harvest units were logged using primarily skyline cable yarding techniques. Road and landing construction and tractor logging were limited to ridgetop and upper slope locations. Based on this study design, other areas in the watershed are likely targeted for even aged management.
CaC-NCSW-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	Jackson Demonstration State Forest, Lyme Timberland, Mendocino County	
CaC-NCSW-19.2.1.3	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	2	100	NMFS	
CaC-NCSW-19.2.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CaC-NCSW-19.2.2.1	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	30	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners, USFS	
CaC-NCSW-19.2.2.2	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, Jackson Demonstration State Forest, NMFS, Private Landowners	
CaC-NCSW-19.2.2.3	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	40	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CaC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	50	NMFS, CDFW, CalFire	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from salmonid streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, Mendocino County Department of Public Works, Private Landowners, RWQCB	These areas are likely already established. Efforts should be made to coordinate storage with all landowners in the basin to minimize costs and impacts.
CaC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, California Department of Mines and Geology, County of Mendocino, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners, RWQCB	Not building problematic roads will likely result in a net cost savings. It is anticipated that little future road construction is planned for the Caspar watershed. Existing floodplains without roads should be avoided under all circumstances.
CaC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	5	CalFire, CDFW, Jackson Demonstration State Forest, NMFS	
CaC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Continue education of Jackson Demonstration State Forest staff and private logging contractors regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	30	CalFire, CDFW, Jackson Demonstration State Forest, NMFS	
CaC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Use best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	30	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-23.1.1.9	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	3	100	CalFire, s Jackson Demonstration State Forest, Private Landowners, RWQCB	Roads that are used for recreational purposes should be patrolled frequently during the winter period to ensure waterbars and other sediment control efforts remain functional throughout the winter period. Unsurfaced roads should also include roads that are lightly rocked and would allow pumping of fine sediment under normal use.
CaC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Reduce road densities by prioritizing high risk areas for decommissioning.	2	20	CalFire, CDFW, County of Mendocino, Jackson Demonstration State Forest, RWQCB, USFS	Priority areas should be those roads adjacent to fish bearing watercourses and smaller tributaries with high sediment delivery potential. The WLPZ road network in the South Fork Caspar should be considered a high priority area for decommissioning.
CaC-NCSW-23.1.1.11	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Coastal Conservancy, CalTrans, CDFW, Jackson Demonstration State Forest, Lyme Timberland, Mendocino County Department of Public Works, NOAA RC, Private Landowners, RCD	
CaC-NCSW-23.1.1.12	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, County of Mendocino, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	It is assumed many culverts have been upgraded on the JDSF managed portion of the forest.
CaC-NCSW-23.1.1.13	Action Step	Roads/Railroads	Decommission high risk roads.	2	5	CalFire, Jackson Demonstration State Forest, Private Landowners	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-23.1.1.14	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	2	10	CalFire, Jackson Demonstration State Forest, Private Landowners	Road densities are high throughout the watershed, estimated at 4.9 miles of road per square mile of watershed area and at 5.7 miles per square mile of riparian area. Roads parallel many of the waterways within Caspar Creek and impinge on channel migration. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality. This is a feasible recommendation for the Caspar watershed due to the fact most of the watershed is in timber management and owned by only a few landowners.
CaC-NCSW-23.1.1.15	Action Step	Roads/Railroads	Implement the Jackson Demonstration State Forest Road Management Plan.	2	20	CalFire, Jackson Demonstration State Forest, Lyme Timberland	
CaC-NCSW-23.1.1.16	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS, Private Landowners	
CaC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
CaC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate				
CaC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners, Public, USFS	
CaC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, California Geological Survey, Jackson Demonstration State Forest, Private Landowners	
CaC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CaC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids during droughts.	2	100	CalFire, Jackson Demonstration State Forest, RWQCB, SWRCB, USFS	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
CaC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CaC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Work with stakeholders to ensure patterns of water runoff, including surface and subsurface drainage, match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalTrans, Jackson Demonstration State Forest, Lyme Timberland, Mendocino County, USFS, NMFS	
CaC-NCSW-24.1.2.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	20	CalFire, Jackson Demonstration State Forest, USFS	Sediment assessment should identify high-risk shallow-seeded landslide areas
CaC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (impaired instream temperature)				
CaC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Work with stakeholders to protect sources of cool water input from future diversions.	1	100	CalFire, CDFW, Jackson Demonstration State Forest, SWRCB, USFS	

Noyo River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 3,200 adults
- Current Intrinsic Potential: 152.8 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

A population abundance survey was conducted by CDFW (Gallagher 2000) in the Noyo River watershed, which estimated the number of adult steelhead in this basin at 361 fish. Additional surveys conducted by CDFW since 2000 report the abundance of adult steelhead spawning in the Noyo River ranging from 186 to 364 fish annually (Gallagher and Wright 2008). Spence *et al*. (2012) estimates that 3,200 total spawners are needed to meet the historical distribution and abundance for this population.

Steelhead trout are present in most tributaries across the Noyo River watershed (USEPA 1999). Private timber companies and resource agencies have documented juvenile distribution throughout the watershed using various survey methods since the 1980s. These surveys that include both electrofishing and snorkeling have shown that steelhead are well distributed across the basin. Surveys are conducted during the summer months when streamflow is low, and typically do not detect juvenile Chinook salmon presence since most fish migrate to the estuary during the late spring and early summer.

Steelhead smolt abundance for the Noyo River has been estimated using outmigration fyke traps operated by CDFW. Gallagher and Wright (2008) reported an estimated 24,484 smolts (>70mm) from the upper Noyo River watershed above Northspur, which represents production from about one half of the watershed area.

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, Pomo Indians likely utilized the fishery resources of the Noyo River. Native Americans also used fire in coastal areas to clear land for tribal activities. In 1853, timber harvest began in the Noyo River area with the first waterpowered mill in the lower Noyo River. Harvesting of old growth timber continued in the Noyo River watershed until the early part of the 20th century (USEPA 1999). In 1940, tractors were used throughout the basin to yard fallen timber, and roads, skid trails and log landings were constructed to ease transport of the logs to sawmills. By the 1960s, some harvesting of second growth timber had begun, with poor timber harvesting practices continuing into the 1980s, although the Forest Practice Act (1973) has progressively improved road and yarding systems.

Roads and railroads associated with timber harvesting have been in the watershed since the 1800s, and in the 1940s railroads were converted to truck roads. Railroad operations began in 1886 in the watershed, with railroad tracks operating east from Fort Bragg to the Little North Fork. Railway service was completed from Fort Bragg to Willits in 1911, including the construction of an extensive set of trestles that cross the Noyo River. Spur tracks were developed to increase logging opportunities in the North and South Fork Noyo subbasins and were later converted into truck roads (GMA 1999). This railroad line remains in use today as the Skunk Railroad, a popular tourist attraction in Mendocino County.

Current Resources and Land Management

Due to the remote location and large public ownership of the Noyo River watershed, a small number of programs and management plans guide land use activities within the basin. Private timber management companies are the largest landowners in the watershed, with Mendocino Redwood Company (MRC) owning the majority of the upper watershed, and Lyme Redwood Company owning much of the lower Noyo River along the mainstem. Jackson State Forest accounts for 19 percent of the watershed which is located in the South Fork subbasin.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, shelter rating, primary pools, pool/riffle ratio for juvenile rearing, smolts and adult lifestages of salmonids. Stream temperature was also rated as Poor for juvenile summer rearing. Indicators for watershed processes that were rated as Poor through the CAP process included watershed road densities, and riparian road densities. Viability for spawning steelhead adults and smolt abundance, and density of juveniles were all rated as Fair based on recent monitoring conducted by CDFW.

Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that rated as Fair through the CAP process, but are considered important within specific areas of the watershed include gravel quality for eggs, baseflow conditions for summer rearing, estuary, and physical barriers.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Noyo River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

CDFW habitat typing surveys indicate that no streams within the Noyo River watershed currently meet target values for shelter. Past timber harvest activities and LWD removal programs in the 1970s through the early 1990s have reduced large woody debris loading across stream reaches in this watershed. Forest canopy has begun to recover, with most stream reaches in the watershed approaching or meeting target values; however, riparian trees that make up the riparian corridor are not of sufficient size and age to deliver woody debris that will provide shelter in the near future. Unsuitable habitat complexity and large woody debris volume are expected to limit salmonids during rearing and migration lifestages by reducing pool frequency and volume, cover habitat, and velocity refuge areas required during freshwater residency.

Water Quality: Temperature

Stream temperatures in the mainstem Noyo River are unsuitable for salmonid rearing. Albin (2006) reports suitable stream temperatures in the coastal area tributaries, yet most of the streams, including the mainstem and interior, do not maintain suitable water temperatures for rearing salmonids during the summer months. The South Fork Noyo River and its tributaries currently have suitable stream temperatures. Stream temperatures are reported to be less suitable for salmonids in the upper mainstem Noyo River, North Fork Noyo River, Hayworth Creek, North Fork Hayworth Creek, Olds Creek, Redwood Creek and Burbeck Creek, despite suitable canopy in these tributaries (Albin 2006).

Overall, stream temperature conditions for this population are rated as Poor due to high stream temperatures that occur across the middle and inland portion of the basin. Although canopy targets are being met in many of the stream reaches surveyed, stream temperature monitoring show that the level of regenerated riparian buffers is not yet adequate to fully protect stream temperatures from warmer conditions.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Sediment transport load from roads in the Noyo River watershed was identified as a stress to overall watershed processes. The USEPA TMDL and other studies (GMA 1999) have identified sediment delivery from roads as a limiting factor for salmonids. Although the egg lifestage was not rated as Poor for impaired gravel quality, many reaches of the watershed have poor spawning habitat and therefore the overall watershed was rated as Fair.

Other Current Conditions

The majority of streams sampled in the Noyo River watershed do not meet target conditions for percent of stream reach with pools and the ratio of pools to riffles. Stream reaches with greater than 40 percent pools and 20 percent riffles are considered suitable for salmonid rearing, migration and feeding. Many of the stream reaches, including the mainstem Noyo River, have a high percentage of flat water habitat types. Poor large woody debris loading across the basin affects pool frequency, and results in increased levels of flat water, or glide-type habitat. Current pool/riffle habitat conditions are expected to limit space for juvenile salmonids, and reduce the carrying capacity during the summer period.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Noyo River CAP results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Noyo River CAP results.

Population and Habitat Threats

Roads and Railroads

Road density throughout the Noyo River watershed was identified as the Highest rated threat. Although sediment quality is not rated as Poor in the basin currently, roads continue to be the largest source of anthropogenic sediment delivery in the basin (USEPA 1999). Road densities are high both across the basin and within riparian areas (7.0 miles per square mile, and 7.4 miles per square mile, respectively).

Graham Matthews & Associates (GMA 1999) found an increase over time in road construction, which has increased sediment yield from surface erosion. Of the 838 miles of roads in the basin, approximately 83 percent are seasonal dirt roads (GMA 1999). According to USEPA (1999), aggressive actions are required to reduce sediment delivery from roads to meet the TMDL allocation for road related sediment. Estimated road-related sediment production for the Noyo River watershed is 183 tons/square mile/year, which is estimated to be an 8 fold increase over 1942 rates.

Logging and Wood Harvesting

Timber has been harvested in the watershed for over 150 years. Improved harvest methods and regulations have reduced the overall impact of this threat in recent decades. Although the rate of harvest in this basin has slowed in the last decade, this threat will continue to exist in the future. For all salmonid lifestages except adults, and overall watershed processes, the threat of timber harvesting activities is rated as a Medium threat. Improved logging methods, such as tree yarding that reduces ground disturbance and reduced harvesting within riparian zones, could keep this threat from returning as a large contributor to habitat stress in the future.

Limiting Stresses, Lifestages, and Habitats

Juvenile summer rearing habitat is impaired by low instream shelter in the form of LWD. The juvenile-rearing and winter-rearing lifestages are limited by the lack of channel complexity instream reaches throughout the basin. Poor channel complexity can alter pool/riffle ratios, reduce instream cover volume, and reduce velocity refuge for salmonids. In addition, the egg lifestage is moderately limited by elevated fine sediment that reduces egg survival to emergence in many spawning areas of the Noyo River and its tributaries. Stream water temperatures occurring in the interior areas of the basin are not suitable and are likely limiting growth and survival of steelhead.

General Recovery Strategy

Improve Habitat Complexity

Restoration actions should improve large woody debris (LWD) frequency across the Noyo River watershed. Riparian areas are in the process of recovery, with stands of smaller diameter conifers that currently buffer stream areas. Strategically adding LWD will provide much needed complexity to stream channels until riparian areas reach maturity, at which time they can begin to recruit LWD naturally to channels. Increasing LWD volumes will improve instream habitat attributes such as pool and riffle frequency and habitat complexity. Increasing the LWD frequency is also expected to improve sediment sorting thereby improving spawning habitat.

Improve Stream Temperatures

The approach to improving riparian conditions in the basin will need to focus on minimizing further riparian vegetation loss and on rehabilitating riparian areas that are currently in poor condition. In addition, there may be opportunity to conduct riparian improvements on specific reaches that may be contributing to stream warming along interior stream reaches.

Improve Habitat and Substrate Quality

Reducing sediment delivery from roads and timber harvest is likely to improve a number of key habitat attributes for salmonids in the Noyo River. Road-related sediment delivery has increased in the recent past and must be reduced. Upgrading or decommissioning roads throughout the basin will lower erosion rates and improve sediment quality, which will in turn improve spawning and juvenile rearing conditions.

Investigate and Address Impairment to Noyo Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Lost Coast Diversity Stratum. Restoration actions should address habitat availability and suitability. However, the current function of this small estuary for providing suitable juvenile rearing conditions is unknown. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the habitat potential of the Noyo River estuary is recommended.

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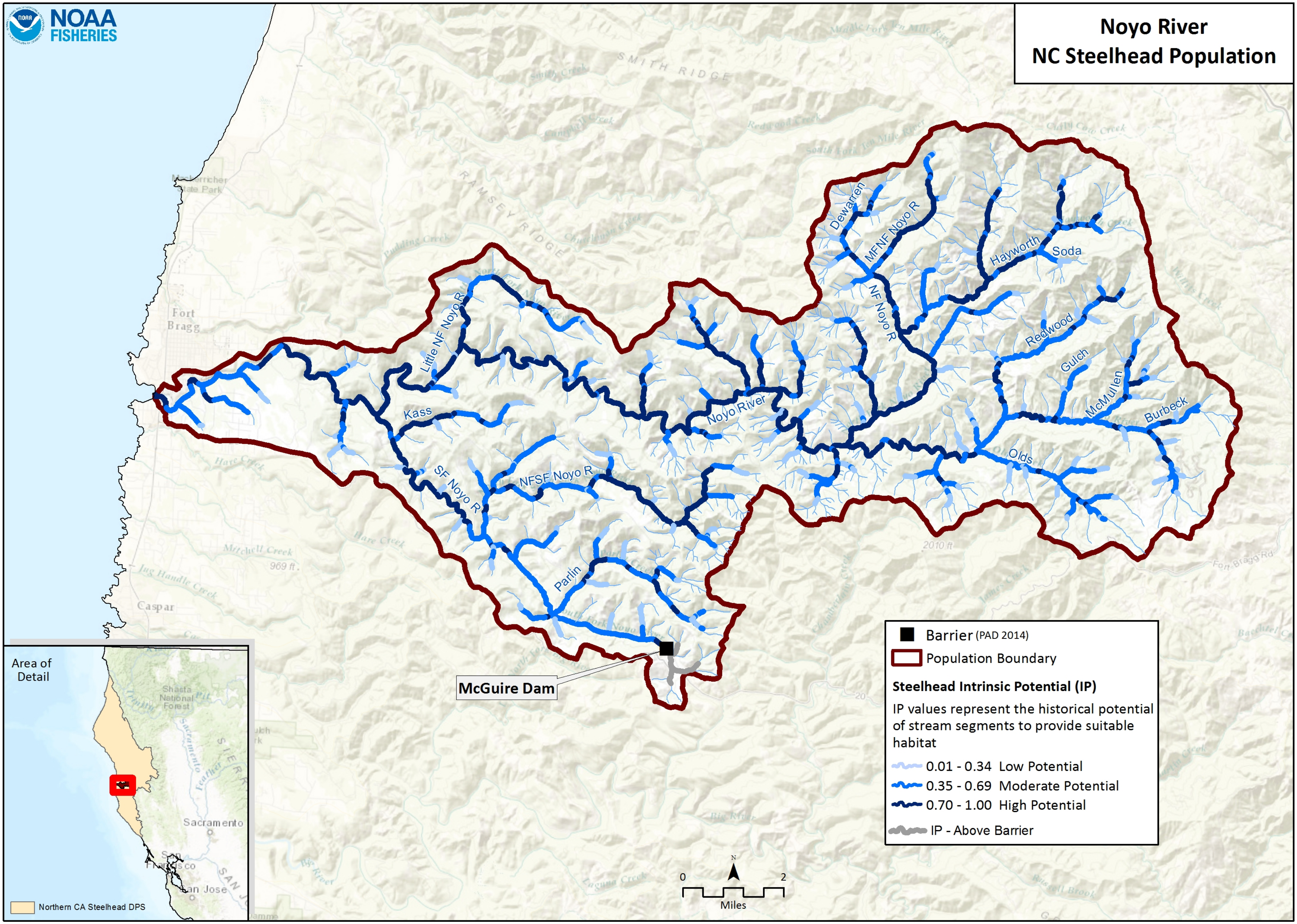

NOAA FISHERIES
Noyo River
NC Steelhead Population
Fort Bragg
Caspar
Dewarren
MFNF Noyo R
Hayworth
Soda
NF Noyo R
Redwood
Gulch
McMullen
Burbeck
Little NF Noyo R
Kass
Noyo River
Olds
SF Noyo R
NFSF Noyo R
Parlin
McGuire Dam
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Barrier
0
2
Miles
Area of Detail
Sacramento
Northern CA Steelhead DPS

NC Steelhead Noyo River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	0 Diversions/10 IP km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	48% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-km (>40% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP km	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	48% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	48% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP km	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	21% in 10yrs and 60% in 20 yrs of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	7.2 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	6.5 Miles/Square Mile	Poor

NC Steelhead Noyo River CAP Threat Results

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific-threats		1	2	3	4	5	6	
1	Agriculture							
2	Channel Modification	Low	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition							
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching							
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Medium	Medium	Medium
9	Mining							
10	Recreational Areas and Activities				Low			Low
11	Residential and Commercial Development	Low			Low			Low
12	Roads and Railroads	Low	Medium	Medium	Medium	Low	High	Medium
13	Severe Weather Patterns	Low	Medium	Medium	Low	Low	Medium	Medium
14	Water Diversion and Impoundments			Medium			Low	Low

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
NoyoR-NCSW-1.1.1.1	Action Step	Estuary	Evaluate enhancement opportunities for Noyo River estuary.	3	5	California Coastal Conservancy, CDFW, County of Mendocino, NMFS	
NoyoR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
NoyoR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate unconfined reaches possessing or having potential for winter rearing habitat restoration.	2	3	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Focus off-channel restoration actions in the lower mainstem Noyo River and areas with high IP-km values (> 0.7).	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
NoyoR-NCSW-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.	2	60	CalFire, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-3.1.1.2	Action Step	Hydrology	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	1	60	CDFW, Jackson Demonstration State Forest, Lyme Timber, Private Landowners, SWRCB	Need to work with private and large industrial timberland owners to develop water storage for summer needs.
NoyoR-NCSW-3.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	20	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-3.1.1.4	Action Step	Hydrology	Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers. Work with the City of Fort Bragg and private landowners in the upper watershed to reduce diversion during the low flow summer period.	3	20	City of Fort Bragg, County of Mendocino, NMFS, SWRCB	
NoyoR-NCSW-3.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
NoyoR-NCSW-3.2.1	Recovery Action	Hydrology	Improve flow conditions				
NoyoR-NCSW-3.2.1.1	Action Step	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, NMFS, NMFS OLE, SWRCB	
NoyoR-NCSW-3.2.1.2	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	3	5	CDFW, NMFS, NMFS OLE, SWRCB	
NoyoR-NCSW-3.2.1.3	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of salmonids. Encourage SWRCB deny additional water diversions from the Noyo River watershed.	3	10	CDFW, NMFS, RWQCB, SWRCB	
NoyoR-NCSW-3.2.1.4	Action Step	Hydrology	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of salmonids and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	3	60	CDFW, Lyme Timber, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
NoyoR-NCSW-5.1.1.1	Action Step	Passage	Assess and restore passage at barriers associated with the California Western Railroad.	2	10	Cal Western Railroad, CDFW, Mendocino Redwood Company	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-5.1.1.3	Action Step	Passage	Restore passage in high priority areas of the Noyo River Watershed as identified in existing fish passage databases.	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
NoyoR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historic salmonid streams to maintain and enhance current stream complexity, pool frequency, and depth.	3	50		
NoyoR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	60	Cal Western Railroad, CalFire, California Coastal Conservancy, California Department of Mines and Geology, CDFW, City of Fort Bragg, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USACE	
NoyoR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information, where germane, from MRC Noyo Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFW stream habitat data to help determine reaches for LWD placement. South Fork Noyo, Little North Fork Noyo and Redwood Creek are priorities for restoration of LWD.	2	10	Cal Western Railroad, CalFire, California Coastal Conservancy, CDFW, City of Fort Bragg, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Pacific States Marine Fisheries Commission, Private Landowners, RWQCB, Trout Unlimited	Projects such as this are directly aimed at improving long-term survival for all freshwater lifestages of salmonids.
NoyoR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Work with the railroad (California Western Railroad) to stop removal of LWD from the Noyo River.	1	10	Cal Western Railroad, CDFW, NMFS, NOAA RC	
NoyoR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Develop and implement LWD projects in the Noyo River watershed using guidance from Albin (2006), Noyo River Watershed Enhancement Plan, or other credible watershed assessments.	2	10	CDFW, NMFS, NOAA RC	
NoyoR-NCSW-6.1.1.6	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	60	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
NoyoR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
NoyoR-NCSW-7.1.1.1	Action Step	Riparian	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	20	CDFW, NMFS, NOAA RC, Private Landowners	
NoyoR-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
NoyoR-NCSW-7.1.2.1	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	60	CalFire, California Coastal Conservancy, CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners	
NoyoR-NCSW-7.1.2.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian no harvest buffers.	2	60	CalFire, California Coastal Conservancy, CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners, Trout Unlimited	
NoyoR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings identified in the MRC Noyo River Watershed Analysis or the Jackson Demonstration State Forest Road Management Plan.	2	5	CalFire, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-8.1.1.2	Action Step	Sediment	NMFS and other landowners will work with RCD or NRCS to encourage sediment reduction assessments beginning with high priority subwatersheds.	2	10	CalFire, CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners, RCD	
NoyoR-NCSW-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CalFire, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-8.1.1.4	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	2	CalFire, CDFW, Mendocino County Department of Public Works, NMFS	
NoyoR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
NoyoR-NCSW-10.1.1.1	Action Step	Water Quality	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	20	CDFW, Hawthorne Timber Co., Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
NoyoR-NCSW-10.1.2	Recovery Action	Water Quality	Improve stream water quality conditions				
NoyoR-NCSW-10.1.2.1	Action Step	Water Quality	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	40	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-10.1.2.2	Action Step	Water Quality	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.	3	30	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-10.1.2.3	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	20	CDFW, Lyme Timber, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners	
NoyoR-NCSW-10.1.2.4	Action Step	Water Quality	Work with landowners to purchase easements on water rights to encourage the maintenance of surface flows.	3	20	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners, SWRCB	
NoyoR-NCSW-10.1.2.5	Action Step	Water Quality	See hydrology, riparian, and temperature sections				
NoyoR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
NoyoR-NCSW-11.1.1.1	Action Step	Viability	Continue and improve upon monitoring activities to determine the population status of adult and smolt salmonids in the watershed and its tributaries.	3	20	CDFW, Lyme Timber, NMFS	
NoyoR-NCSW-11.1.1.2	Action Step	Viability	Continue funding the life cycle monitoring station	1	5	Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-11.1.1.3	Action Step	Viability	Continue juvenile monitoring efforts initiated by Burns (1972) and continued by Valentine and Jamison (CDF 1992) and Georgia-Pacific Corp. and Campbell Timberland Management (1994-1998) in Little North Fork Noyo River.	2	60	CDFW, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-11.1.1.4	Action Step	Viability	Identify if the population is at short-term or immediate risk of extinction.	2	5	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-11.1.1.5	Action Step	Viability	Identify how a conservation hatchery/supplementation/ augmentation program will complement the overall recovery effort.	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-11.1.1.6	Action Step	Viability	If determined necessary, identify an out-of-basin source population that could be used to start a population augmentation/supplementation/broodstock program.	2	20	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-19.1.1.1	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, and disconnected from the stream network as appropriate.	2	40	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners	
NoyoR-NCSW-19.1.1.2	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission or upgrade them, and revegetate the area with appropriate native species.	2	10	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	
NoyoR-NCSW-19.1.1.3	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	Board of Forestry, CalFire, CDFW, Mendocino Redwood Company, NMFS	
NoyoR-NCSW-19.1.1.4	Action Step	Logging	Develop a California Forest Practice monitoring protocol to determine whether specific practices are effectively meeting intended objectives and are providing for the protection of salmonids.	3	20	CalFire, NMFS, CDFW, Jackson State Demonstration Forest	
NoyoR-NCSW-19.1.1.5	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	3	20	CDFW	
NoyoR-NCSW-19.1.1.6	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFW Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	3	5	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NMFS	
NoyoR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
NoyoR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas within the Noyo River watershed.	2	60	CalFire, CDFW, Mendocino County, NMFS, RWQCB	
NoyoR-NCSW-19.2.1.2	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency of operations within salmonid areas.	2	40	Board of Forestry, CalFire, Mendocino Redwood Company, NMFS, Private Consultants	
NoyoR-NCSW-19.2.1.3	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	10	CalFire, Lyme Timber, NMFS, Private Consultants, Private Landowners	
NoyoR-NCSW-19.2.1.4	Action Step	Logging	Provide information to BOF regarding salmonid requirements and recommend upgrading relevant forest practices.	2	60	CalFire, Lyme Timber,Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-19.2.1.5	Action Step	Logging	Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through ESA Section 10(a)(1)(B).	3	5	NMFS	
NoyoR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NoyoR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	5	Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners, Trout Unlimited	
NoyoR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	20	CalTrans, Lyme Timber, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	20	CalFire, Lyme Timber, CDFW, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	10	Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Encourage County of Mendocino to address and adequately maintain the Sherwood Ridge Road. Encourage County of Mendocino to completely close and monitor gates and barriers during the winter period.	2	10	Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Design and implement a program of BMPs for road maintenance on private roads similar to the program for public roads (Sommarstrom et al., 2002).	2	20	Mendocino County Department of Public Works, NOAA RC, Private Landowners, NMFS	
NoyoR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in high priority areas should be considered an extremely high priority for funding (e.g., PCSRF).	2	10	CDFW, NMFS	
NoyoR-NCSW-23.1.1.8	Action Step	Roads/Railroads	Fully implement the Noyo River TMDL.	3	30	CDFW, Lyme Timber, Mendocino Redwood Company, Private Landowners, RWQCB	
NoyoR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	20	NMFS, CDFW	
NoyoR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Continue education of County road engineers, timber company, and railroad maintenance staff regarding watershed processes and the adverse effects of improper road/railroad construction and maintenance to salmonids and their habitats.	2	60	CalFire, Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.2.3	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	10	CalTrans, Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
NoyoR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	5	CalFire, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.3.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	60	Cal Western Railroad, California Department of Mines and Geology, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**				
NoyoR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CDFW, Lyme Timber, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-23.2.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	60	Cal Western Railroad, CalFire, California Department of Mines and Geology, Lyme Timber, Mendocino Redwood Company, NRCS, Private Landowners, RWQCB	
NoyoR-NCSW-23.2.1.3	Action Step	Roads/Railroads	Ensure all existing and new road and railway crossings minimize potential sediment delivery to the stream environment and meet CDFW and NMFS standards for upstream and downstream passage of adult and juvenile salmonids.	2	20	Cal Western Railroad, CDFW, NMFS, NOAA RC	
NoyoR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
NoyoR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
NoyoR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Develop and implement a stream flow model to estimate critical flow levels for the mainstem Noyo River impacted by water diversions for the City of Fort Bragg.	3	10	CDFW, NMFS, Private Landowners, SWRCB	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows during drought years.	3	10	City of Fort Bragg, Lyme Timber, Mendocino Redwood Company, Private Landowners	

Ten Mile River Population

NC Steelhead Winter-Run

- Role within DPS or ESU: Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 3,400 adults
- Current Intrinsic Potential: 171.1 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The first known estimate of steelhead abundance in the Ten Mile River Watershed was 9,000 spawning adults according to the California Fish and Wildlife Plan (CDFG 1965). In the Fish and Wildlife Plan, CDFW estimated that the Ten Mile River possessed an estimated 103 miles (165 km) of steelhead habitat. This estimate from 1965 is less than the TRT (Spence *et al*. 2008) estimate of 205 km (weighted) of habitat. The 1965 population estimate is believed to have not been based on an actual survey and should be viewed with caution. In the early 1960s, numerous stream surveys by CDFW documented the presence of juvenile steelhead throughout the three major subwatersheds (South Fork, North Fork, Clark Fork) and their tributaries. These stream surveys were generally focused on documenting major blockages to adult salmon and steelhead migration, and information on steelhead presence was generally included as supplemental information rather than quantitative estimates. Information from these surveys may have provided some basis for the 1965 estimate of spawner abundance.

Quantitative information on juvenile steelhead was first estimated by CDFW in 1983 at seven locations. Densities ranged from a high of 2.37 f/m^2 at Bear Haven Creek to a low of 0.20 f/m^2 at Bald Hill Creek (Harris, unpublished data, 2011). CDFW conducted another survey of juvenile density in 1991, at ten locations across the watershed. Densities ranged from a high of 0.80 f/m^2 on Little North Fork Ten Mile to a low of 0.17 f/m^2 on a mainstem location on North Fork Ten Mile (Harris, unpublished data 2011). In 1992, the Salmon Restoration Association (Maahs 1992) sampled ten locations in Ten Mile and found juvenile steelhead densities ranging between 0.13 f/m^2 and 0.80 f/m^2. In 1993, Georgia-Pacific Corp initiated an extensive juvenile monitoring program using fixed 30+ meter reference locations from 24 sample sites. All 24 sampling locations were sampled on a yearly basis between 1993 and 1999. The average of yearly juvenile density in basin-wide estimates ranged from 0.35 f/m² in 1998 to 0.67 f/m² in 1994 (Ambrose and Hines 1998; Ambrose 2010). Over the seven year sampling duration, one site on the mainstem of South Fork Ten Mile above the Redwood Creek confluence consistently recorded the highest average density estimates, with a basin high of 2.32 f/m² in 1994 (Ambrose and Dreier 1994). Steelhead densities from this location were greater than 1.0 f/m² in five of the seven years sampled (Ambrose 2010).

The Salmon Trollers Marketing Association (Maahs 1996a; Maahs 1997a) estimated smolt abundance in South Fork Ten Mile near the Campbell Creek confluence in 1995, and at two additional locations in 1996, and 1997: Campbell Creek and Smith Creek. In 1995, steelhead smolt abundance in South Fork Ten Mile was estimated at 2,400. In 1996, steelhead smolt abundance was estimated at 2,379 (Campbell Creek), 3,954 (Smith Creek), and 10,500 (South Fork Ten Mile). In 1997 steelhead smolt abundance was estimated at 2,367 (Campbell Creek), 1,700 (Smith Creek), and 3,172 (South Fork Ten Mile).

Starting in the 1989, spawning surveys were sporadically conducted in the Ten Mile River (Salmon Trollers Marketing Association Inc. 1990; Maahs and Gilleard 1994; Maahs 1996b; Maahs 1997b). These surveys focused on documenting Chinook salmon and coho salmon presence and abundance, and were not focused at estimating steelhead abundance. In 2009/2010, Campbell Timberland Management and CDFW initiated sampling in the Ten Mile River watershed according to criteria in an action plan for monitoring California's coastal salmonid populations (Boydstun and McDonald 2005). This monitoring was the first effort at quantifying steelhead adult abundance in the watershed. Under this monitoring scheme, sampling consists of extensive regional spawning surveys to estimate escapement based on redd counts selected under a random stratified survey of ten percent of available habitat each year. The 2009/2010 basin-wide estimate of spawning abundance was estimated at 190 adults (95 percent CI: 59 to 321) (Wright, unpublished data, 2010).

History of Land Use

The history of the Ten Mile River watershed is largely defined by timber harvest, which began in the lower basin about 1870. The first railroad in the area was developed in the 1910s, connecting the South Fork Ten Mile with a sawmill in Fort Bragg. Railroads were extended into the Middle and North Forks by the early 1920s. Until about 1940, the South Fork Ten Mile provided the major log supply to the Union Lumber mill in Fort Bragg. In the 1930s, tractor yarding began to replace railroad yarding, and most of the railroad grades were converted to roads. Major portions of the watershed were harvested between the mid-1940s and the mid-1960s using tractor yarding, with its associated road, skid trails, log layouts, and landing construction. Relative to the 1940-

1960 period, harvest levels were apparently far lower between the late 1960s and the mid-1980s because the old growth forest was depleted and the forest was left to regenerate. Since the mid-1980s most of the watershed is managed using approximately a 60 year average rotation age (GMA 2000 - excerpted from USEPA 2000).

Current Resources and Land Management

The Ten Mile River watershed is entirely privately owned, with Hawthorne Timber Company, LLC (managed by Campbell Timberland Management, LLC), the successor to Georgia-Pacific West, owning about 85 percent of the watershed. Three small non-industrial timber owners and a handful of other residences also own land within the watershed. In general, the forests of the Ten Mile watershed are on their second rotation with a significant proportion of the second growth forests being harvested over the last 25 years.

Numerous restoration projects have occurred in the Ten Mile River, including barrier modifications (generally culvert upgrades), upslope sediment remediation, and instream habitat enhancement. Until recently, most restoration actions were focused on reducing sediment input from upslope roads associated with ongoing timber management. In the past few years, Campbell Timberland Management has conducted, with funding through FRGP, significant effort to improve instream habitat complexity for salmonids through the addition of large woody material. Initial efforts were focused on the South Fork Ten Mile, and today the majority of the South Fork mainstem has been enhanced with LWD. LWD recruitment efforts are now focused on the North Fork Ten Mile and Clark Fork Ten Mile. In 2010 and 2011, approximately 15 miles of mainstem North Fork were enhanced with LWD. Campbell Timberland has indicated that these efforts will continue into the near future (D. Wright, Campbell Timber, personal communication, 2010).

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, riparian vegetation, sediment transport, and rate of harvest. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Ten Mile River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Ten Mile River watershed are poor within all sampled reaches and this is a limiting factor for the summer rearing and smolt lifestages. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat according to shelter rating values. LWD was likely removed during past land management activities and well-intentioned but frequently over ambitious stream clearing practices. However, since these surveys were conducted, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the South Fork, Clark Fork and North Fork. To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future by Campbell Timberland Management (CTM) (D. Wright, Campbell Timber, personal communication, 2011). While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM) are not at the viability targets for these attributes.

Sediment Transport: Road Density

High levels of instream fine sediment and turbidity likely impair the egg, smolt, and winter rearing lifestages within many basins in the Ten Mile River Watershed. The Ten Mile River is considered impaired due to high instream sediment conditions (USEPA 2000). The source analysis in the Ten Mile TMDL included an assessment of sediment sources historically and/or presently impacting water quality. Several management-related factors have contributed to the elevated sediment delivery rates throughout the watershed, primarily the high rate of timber harvest and associated road building. While overall rates have declined in the 67-year study period from 1933-1999, USEPA (2000) determined that sediment generation from road surface erosion had increased. This is not surprising considering the high density of unsurfaced roads in the watershed. Current sediment delivery from all sources is estimated at 629 tons/mi^2/year, with about 50 percent of the total amount attributed to natural processes (*i.e.*, background) and the rest management-related (USEPA 2000).

Other Current Conditions

Altered riparian conditions are common throughout the Ten Mile River watershed, elevating summer water temperatures in some reaches and limiting LWD recruitment. Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for the Ten Mile watershed suggests that riparian stands are relatively well stocked, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (*e.g.*, old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Recruitment of trees of sufficient size and length into the stream channel is likely at a slower rate than under historical conditions, due in part to the much younger age of the extant riparian stands. Conversion of the lower sections of the mainstem Ten Mile River from conifers to grassland for cattle grazing has likely lowered riparian function and diversity adjacent to some of better rearing areas in the lower watershed.

Overall, the Ten Mile watershed is subject to fewer stresses than many other watersheds in the NC Steelhead DPS due to a singular land use (timber harvest) and a lack of urban or rural residential impacts.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Ten Mile River CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Ten Mile River CAP Results.

Roads and Railroads

Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in the Ten Mile watershed. Road densities are high throughout the watershed and are estimated at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. Many of these roads were poorly situated and constructed[1], improperly maintained, and many have been abandoned rather than properly decommissioned.

Fire, Fuel Management, and Fire Suppression

Some areas in the Ten Mile River watershed have High fire hazard rating according to CalFire data. A major fire, particularly if located in areas with High erosion hazard rating could result in major increases in fine sediment and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures would likely result.

Logging and Wood Harvesting

Timber harvest remains a threat to steelhead habitat in the Ten Mile River, but at diminished levels compared to historical practices. For steelhead, timber harvest was listed as a threat for watershed processes due in large part to the high rate of harvest in many of the planning

[1] The majority of these roads were constructed prior to the passing of the California Forest Practices Rules in 1973.

watersheds. Even with application of new California Forest Practice Rules this threat is anticipated to continue into the foreseeable future.

Severe Weather Patterns

Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting high risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat.

Other Threats

No fish hatcheries currently operate within the Ten Mile watershed. In the past the Salmonid Restoration Association operated a small hatchery near Vallejo Gulch. This operation was discontinued in approximately 2000 and the remaining infrastructure was removed about five years ago. The limited duration of hatchery operations and relatively small number of steelhead spawned and released suggest adverse hatchery-related effects were unlikely within the steelhead population. Similarly, invasive species are not known to be problematic within the basin. Illegal marijuana cultivation occurs in some areas, and has the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. General estuary conditions are unknown but should be investigated in the future due to the intact nature of the estuary and the importance of these habitats to provide superior rearing habitat for juvenile steelhead. NMFS is aware of unsubstantiated reports regarding unauthorized fishing in the estuary, which may impact rearing juveniles during the summer period.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Ten Mile watershed. Inadequate habitat complexity in many stream reaches reduces rearing habitat availability, resulting in a decrease in stream carrying capacity. Sediment input into Ten Mile River from upslope land disturbance (principally unsurfaced logging roads) continues to impact instream habitat conditions, likely resulting in pools becoming filled and food availability decreasing in riffle habitats. Restoration actions should continue current efforts at increasing instream habitat complexity to appropriate viability level targets and remediating upslope sources of sediment contribution.

General Recovery Strategy

Improve LWD Volume

Many reaches of the Ten Mile River watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. Fencing and planting in the floodplains could result in major improvement to the lower reaches of the South Fork and mainstem Ten Mile River. As stated above, Campbell Timberland Management has initiated a program of LWD supplementation to enhance habitat complexity. Continuation of this program will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones.

Address Upslope Sediment Sources

Active and abandoned logging roads and skid trails are located throughout the basin and likely contribute large volumes of sediment into the stream environment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Ongoing road work should include a component that closes and decommissions unnecessary and abandoned roads and skid trails to effectuate lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

Investigate and Address Current Estuary Conditions

The Ten Mile River estuary is one of the most intact estuaries within the range of steelhead, in that it has very little anthropogenic infrastructure or other ongoing impacts. However, the current function of the estuary for providing suitable juvenile rearing conditions is unknown. NMFS is not aware of any current or historical water quality sampling or systematic evaluation of physical habitat conditions for rearing. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate current conditions and determine if conditions could be improved.

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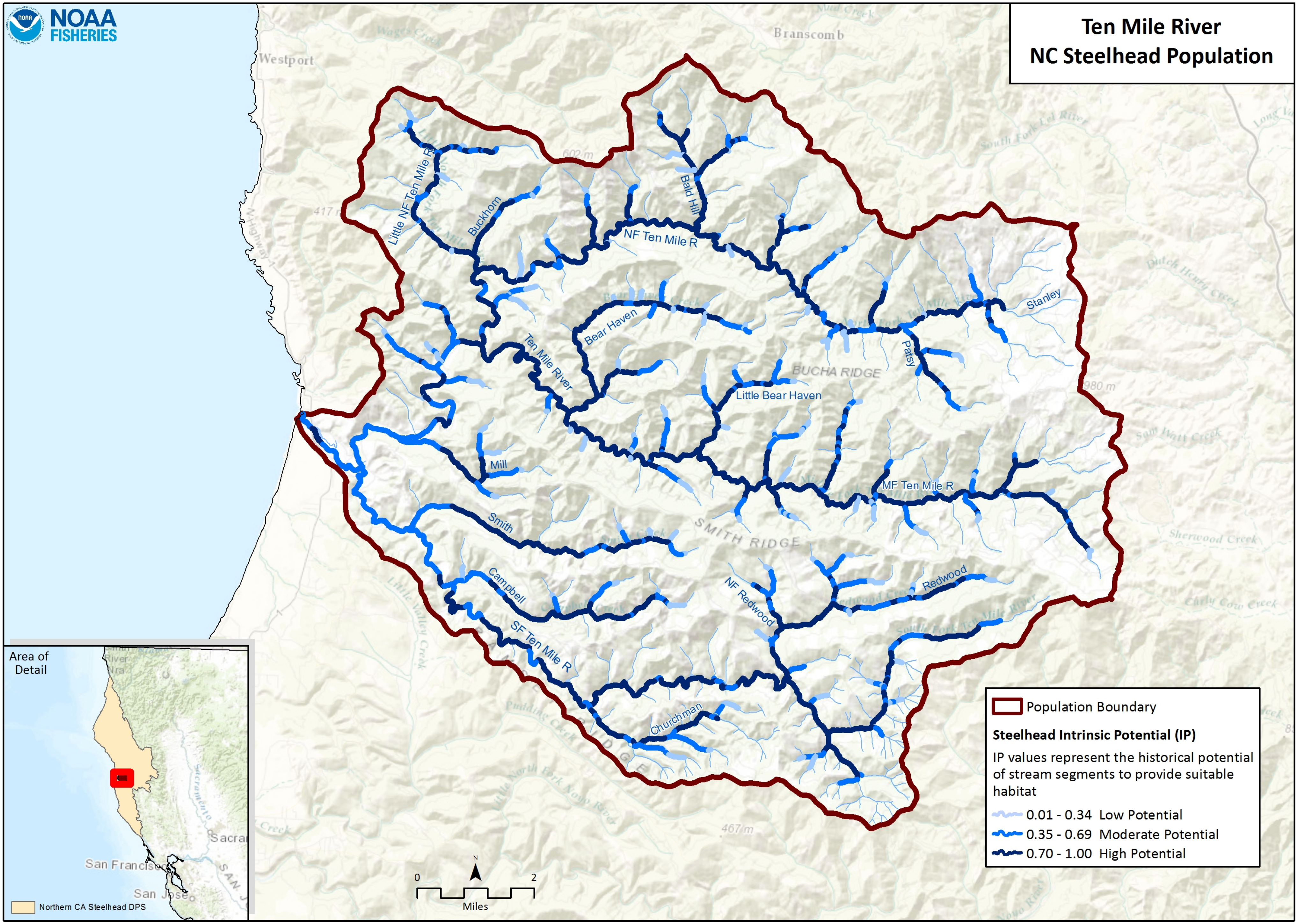
NOAA FISHERIES
Ten Mile River
NC Steelhead Population
Westport
Branscomb
BUCHA RIDGE
SMITH RIDGE
Little NF Ten Mile R
Buckhorn
Bald Hill
NF Ten Mile R
Bear Haven
Ten Mile River
Stanley
Patsy
Little Bear Haven
Mill
MF Ten Mile R
Smith
Campbell
NF Redwood
Redwood
SF Ten Mile R
Churchman
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
0
2
Miles
N

NC Steelhead Ten Mile River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	87% of streams/ IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower.	Poor
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	0.40-0.49 LWD Jams over 138403m	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-Km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	87% of streams/ IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	67% of streams/ IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	87% of streams/ IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.16% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	5% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	42% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	7.2 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	6.2 Miles/Square Mile	Poor

NC Steelhead Ten Mile River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Low	Medium
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low
3	Disease, Predation and Competition	Low	Low	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	High	Medium	Medium	High
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Medium	High	High
9	Mining	Low	Low	Medium	Medium	Low	Low	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	Medium	High	Medium	High	High
13	Severe Weather Patterns	High	Medium	Medium	Medium	High	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Low	Low	Medium

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat				
TenMR-NCSW-1.1.1.1	Action Step	Estuary	Complete an estuary study to evaluate limiting factors in Ten Mile River estuary.	3	5	CDFW, RWQCB, The Nature Conservancy, Trout Unlimited	Development of a multi-disciplinary Technical Advisory Committee (TAC) to develop the scientific foundation for this study is recommended. The TAC should be familiar with other estuaries and estuary reaches within the Lost Coast Diversity Stratum as well as past and ongoing studies within the CCC DPS.
TenMR-NCSW-1.1.1.2	Action Step	Estuary	Develop Estuary Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.	2	5	CDFW, NMFS, NOAA RC, NOAA SWFSC	
TenMR-NCSW-1.1.1.3	Action Step	Estuary	Where feasible, remove structures and modify practices that degrade or reduce the historical estuarine extent or functions to benefit salmonids.	3	5	Private Landowners, The Nature Conservancy, Trout Unlimited	Ten Mile Estuary is relatively intact and likely has few structures that have significantly modified the historical tidal prism and feeding and transition habitat.
TenMR-NCSW-1.1.1.4	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CDFW, Private Landowners, The Nature Conservancy	Targeting likely limiting factors such as over wintering and smolt transition habitats should be a high priority.
TenMR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge				
TenMR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	5	CalFire, CDFW, Lyme Timberland Private Landowners	These actions should initially target habitat in high priority areas and the lower portions of the three mainstems (North Fork, Clark Fork, and South Fork).
TenMR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Existing beaver habitat should be protected, and issues related to flooding resolved without the removal of beaver habitat (e.g. flow reduction devices, etc.)	3	100	CalFire, CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
TenMR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	CDFW, Lyme Timberland, Private Landowners, The Nature Conservancy, Trout Unlimited	Data from CDFW habitat inventories indicate shelters throughout the Ten Mile River watershed are poor within all sampled reaches and this is a limiting factor for the summer rearing and smolt lifestages. LWD was likely removed during past land management activities and well intentioned stream clearing practices. However, since these surveys were completed in the mid-1990's, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the South Fork, Clark Fork and North Fork using the Accelerated Recruitment approach. To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future. While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM (now Lyme) are not at the viability targets for these attributes.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	3	50	CDFW, Lyme Timberland, Private Landowners, The Nature Conservancy, Trout Unlimited	
TenMR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	2	100	CalFire, Lyme Timberland, Private Landowners, RPFs	Promoting growth could include such actions as riparian permanent retention strategies of larger diameter trees and/or conifer release strategies, particularly in areas dominated by hardwoods that historically support conifers. Since the majority of land management practices in the Ten Mile is timber management, this recommendation should be incorporated into ongoing practices and little additional cost is anticipated for successful implementation. Particular attention should be directed at the lower mainstem reaches of Ten Mile which maintain high IP values but where riparian conifer stands are limited due to historical conversion from forest to grazing lands.
TenMR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	30	CalFire, Lyme Timberland Private Landowners, RPFs	
TenMR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	100	CalFire, CDFW, Lyme Timberland, Private Landowners, RCD, RWQCB	To implement this recommendation, additional streamlining of the THP process for LWD input by regulatory agencies is necessary. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. In Ten Mile stream reaches where there is little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Installing large woody material into a stream deficient in large wood should be considered a top restoration priority.
TenMR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelters				
TenMR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	Lyme Timberland, Private Landowners	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	5	CDFW, Lyme Timberland, Private Landowners, The Nature Conservancy	In addition to projects that increase large wood volumes in the three major subwatersheds and their tributaries attention should also be focused in the lower floodplain areas along the lower South Fork Ten Mile and areas below the Clark Fork/North Fork confluence. Projects designed to increase winter refuge habitat in these floodplain areas should be considered a high priority for salmonid habitat recovery. In the past few years, Campbell Timberland Management (now Lyme Timberland) has conducted significant effort to improve instream habitat complexity for salmonids through the addition of large woody material. Initial efforts were focused on the South Fork Ten Mile, and today the majority of the South Fork mainstem has been enhanced with LWD. LWD recruitment efforts are now focused on the North Fork Ten Mile and Clark Fork Ten Mile. In 2010 and 2011, approximately 15 miles of mainstem North Fork were enhanced with LWD. Campbell Timberland (now Lyme Timberland) has indicated that these efforts will continue into the near future.
TenMR-NCSW-6.1.2.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CalFire, CDFW, Private Landowners, RWQCB, USACE	
TenMR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
TenMR-NCSW-7.1.1.1	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other salmonid needs.	2	50	Lyme Timberland, Mendocino Land Trust, Private Landowners	
TenMR-NCSW-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	50	Lyme Timberland, Mendocino Land Trust, Private Landowners	
TenMR-NCSW-7.1.1.3	Action Step	Riparian	Place conservation easements on riparian areas.	2	50	Lyme Timberland, Mendocino Land Trust, Private Landowners	Conservations easement can provide an effective conservation strategy for salmonid conservation. Conservation easements facilitate the protection of watershed processes by focusing on areas of particular importance at a relatively reasonable cost (compared to fee title).
TenMR-NCSW-7.1.1.4	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	3	100	Lyme Timberland	This is a contentious issue on most managed forestlands.
TenMR-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
TenMR-NCSW-7.1.2.1	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, CDFW, Lyme Timberland, Private Landowners	Many of the areas historically used for agricultural purposes have been extensively cleared of all riparian vegetation. Targeting restoration in these areas may result in some lands no-longer being farmed for hay production, etc. Landowner outreach will likely be required in these areas.

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Lyme Timberland, Private Landowners	Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for Ten Mile watershed suggests that riparian stands are relatively well stock, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands.
TenMR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-8.1.1	Recovery Action	Sediment	Improve quantity and distribution of spawning gravels				
TenMR-NCSW-8.1.1.1	Action Step	Sediment	Fully implement Ten Mile River TMDL.	2	20	CalFire, Lyme Timberland, Private Landowners, RWQCB	High levels of instream fine sediment and turbidity likely impair the egg, smolt, and winter rearing lifestages within many basins in Ten Mile River Watershed (USEPA 2000). The source analysis in Ten Mile TMDL included an assessment of sediment sources historically and/or presently impacting water quality. Several management-related factors have contributed to the elevated sediment delivery rates throughout the watershed, primarily the high rate of timber harvest and associated road building. While overall rates have declined in the 67-year study period from 1933-1999, the USEPA (2000) determined that sediment generation from road surface erosion had increased. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for salmonid protection.
TenMR-NCSW-8.1.1.2	Action Step	Sediment	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey, Lyme Timberland, Private Landowners, RWQCB	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identifying areas for prioritization.
TenMR-NCSW-8.1.2	Recovery Action	Sediment	Improve instream gravel quality				
TenMR-NCSW-8.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Lyme Timberland, Private Landowners, RWQCB	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain or remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-8.1.2.2	Action Step	Sediment	Stabilize the Miller Pond dam in Little North Fork Ten Mile to prevent catastrophic failure and massive sediment input into critical downstream spawning and rearing areas.	1	5	CDFW, Private Landowners, RWQCB	Little North Fork Ten Mile is one of the most important streams in Ten Mile River watershed.
TenMR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
TenMR-NCSW-10.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient (i.e., lower reaches of North Fork and South Fork).	2	20	CalFire, Lyme Timberland, Private Landowners, RWQCB	Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Conversion of the lower sections of the mainstem Ten Mile River from conifers to grassland for cattle grazing and agriculture has likely lowered riparian function and diversity adjacent to some of better rearing areas in the lower watershed. Reestablishing a functional riparian forest in these areas (provided landowners are willing) will likely require extensive oversight (watering, cattle exclusion) until the trees become established. Altered riparian conditions are common throughout Ten Mile River watershed, elevating summer water temperatures in some reaches and limiting LWD recruitment.
TenMR-NCSW-10.1.2	Recovery Action	Water Quality	Reduce turbidity and suspended sediment				
TenMR-NCSW-10.1.2.1	Action Step	Water Quality	Work with stakeholders to develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	5	CalFire, Lyme Timberland, Private Landowners, RWQCB	
TenMR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
TenMR-NCSW-11.1.1.1	Action Step	Viability	Monitor population status.	1	25	Lyme Timberland, CDFW, Private Landowners	
TenMR-NCSW-11.1.1.2	Action Step	Viability	Perform standardized adult spawning (redd) surveys.	2	5	CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-11.1.1.3	Action Step	Viability	Initiate smolt outmigration study.	3	3	CDFW, Lyme Timberland, NOAA SWFSC	
TenMR-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various salmonid life stages.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, Lyme Timberland, Private Landowners	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
TenMR-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations (e.g., picking up water from areas other than Ten Mile River lagoon). Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
TenMR-NCSW-15.1.2.2	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, USFS, and regulatory agencies with expertise in fisheries issues.	3	50	CalFire, Lyme Timberland, USFS	
TenMR-NCSW-15.1.2.3	Action Step	Fire/Fuel Management	Disseminate plan to all local fire fighting agencies.	2	3	CalFire, Lyme Timberland	
TenMR-NCSW-15.1.2.4	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing fire fighting assistance in the Ten Mile watershed (and all other watersheds in the County).	2	100	CalFire, Lyme Timberland	
TenMR-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TenMR-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire	Do not pull water from the lagoon during fire unless absolutely necessary.
TenMR-NCSW-15.1.4	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
TenMR-NCSW-15.1.4.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
TenMR-NCSW-15.1.4.2	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	100	CalFire, County of Mendocino	
TenMR-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**				
TenMR-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
TenMR-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	2	CalFire	
TenMR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-19.1.1.1	Action Step	Logging	Work with stakeholders to maintain and expand California's working forestlands and forestlands held by the State, and minimize future conversion of forestlands to agriculture or other land uses.	3	50	CalFire, Lyme Timberland, Private Landowners, County	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-19.1.1.2	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to off-channel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Lyme Timberland, Private Landowners	Timber harvest remains a threat to salmonid habitat in Ten Mile River, but at diminished levels compared to historical practices. Timber harvest was listed as a threat for watershed processes due in large part to the high rate of harvest in many of the planning watersheds. Even with application of new California Forest Practice Rules this threat is anticipated to continue.
TenMR-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TenMR-NCSW-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Lyme Timberland, Private Landowners	Road surface treatment options will vary widely on road use and geology.
TenMR-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
TenMR-NCSW-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Lyme Timberland, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
TenMR-NCSW-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CalFire, Lyme Timberland CDFW, Private Landowners, RPFs	Conifer release should not be conducted in thermally impaired reaches unless there is significant oversight by a qualified biologist.
TenMR-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.4.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, Lyme Timberland, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
TenMR-NCSW-19.1.4.4	Action Step	Logging	Minimize timber harvest on unstable slopes adjacent to headwater streams in the North Fork Ten Mile.	2	30	CalFire, CDFW, RPFs, RWQCB	
TenMR-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
TenMR-NCSW-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.5.2	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, Lyme Timberland Private Landowners	
TenMR-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
TenMR-NCSW-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Lyme Timberland, Private Landowners	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-19.1.6.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Lyme Timberland, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
TenMR-NCSW-19.1.6.3	Action Step	Logging	Reduce the amount and rate of even aged management.	2	550	CalFire, CDFW, Lyme Timberland, Private Landowners	Changing silviculture practices to uneven age management will likely reduce channel bank erosion and channel incision. Research has found a linkage between increased peak flows associated with clearcut harvesting in small headwater basins and increased sediment yields due to channel expansion.
TenMR-NCSW-19.1.6.4	Action Step	Logging	Use aerial yarding systems rather than ground-based yarding methods.	2	100	CalFire, CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.7	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
TenMR-NCSW-19.1.7.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.7.2	Action Step	Logging	Minimize new road construction in riparian zones	2	100	CalFire, Lyme Timberland, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to headwater streams with high IP value habitat.
TenMR-NCSW-19.1.7.3	Action Step	Logging	Establish equipment limitation zones on headwater streams and swales.	2	100	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
TenMR-NCSW-19.1.7.4	Action Step	Logging	See Roads and Railroads for additional recommendations.				
TenMR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
TenMR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
TenMR-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.2.1.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of salmonids.	3	20	CalFire, Lyme Timberland, Private Landowners	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Other considerations could potentially cover timber harvest activities for multiple watersheds within Mendocino County. A multiple landowner HCP is preferable due to economy of scale and overall, similar land management actions across the watershed.

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-19.2.1.3	Action Step	Logging	Assign NMFS staff to conduct THP reviews and provide protective recommendations to avoid take of listed salmonids by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	20	NMFS	The need for this action may change if the California Forest Practice Rules change to be more protective of salmonids or the state receives incidental take authorization through the HCP process.
TenMR-NCSW-19.2.1.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	CalFire, Lyme Timberland, Private Landowners	Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
TenMR-NCSW-19.2.1.5	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners	
TenMR-NCSW-19.2.1.6	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, Mendocino County, Private Landowners	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
TenMR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
TenMR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	5	CalFire, Lyme Timberland, Private Landowners	All new and replacement culverts should be sized to accommodate a 100 year flow event.
TenMR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, Lyme Timberland, Private Landowners	These will likely be replaced as part of future timber harvest plans in Ten Mile watershed.
TenMR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	20		
TenMR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Continue education of County road engineers and maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	10	CalFire, Lyme Timberland, Mendocino County Department of Public Works, Mendocino County RCD, Private Landowners, RWQCB	There are few County roads in the watershed but those that occur should be carefully evaluated.
TenMR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	30	CalFire, Lyme Timberland, Private Landowners	Legacy roads from past logging activity continue to impact Ten Mile watershed. Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in Ten Mile watershed. Road densities are high throughout the watershed and are estimated at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. Many of these roads were poorly situated and constructed, improperly maintained, and many have been abandoned and not properly decommissioned.
TenMR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Lyme Timberland, Private Landowners	Many roads in the watershed have inside ditches.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	CalFire, Lyme Timberland, Private Landowners	Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input.
TenMR-NCSW-23.1.2.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Lyme Timberland, Private Landowners	Sediment traps will require a significant maintenance commitment. Conduct inventory of culverts needing sediment traps.
TenMR-NCSW-23.1.2.5	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Lyme Timberland, Private Landowners	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct inventory of culverts needing energy dissipaters.
TenMR-NCSW-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	2	5	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.1.2.7	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	CalFire, Lyme Timberland, Private Landowners	Many logging roads have been upgraded to modern standards, but a lot of work remains before this sediment source is thoroughly minimized. An effective road program should include a component that closes and remediates unnecessary roads and skid trails in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed. The potential for sediment (both through chronic input and large episodic events) is likely to continue. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules.
TenMR-NCSW-23.1.2.8	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, Lyme Timberland, Private Landowners, Trout Unlimited	Focus initial efforts (and/or continue ongoing efforts) in Little North Fork Ten Mile, Bear Haven (CDFG 2004), Mill, Campbell, and Smith Creeks. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. TU has partnered with CTM and Pacific Watershed Associates to upgrade 3.4 miles of inner gorge roads in Little North Fork which should be considered a major priority considering the importance of the salmonid populations in the Little North Fork.
TenMR-NCSW-23.1.2.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	100	CalFire, Lyme Timberland, Private Landowners, RWQCB	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-23.1.2.10	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	2	20	CalFire, California Department of Mines and Geology, Lyme Timberland, Mendocino County Department of Public Works, Private Landowners, RWQCB	This recommendation is likely very feasible within the Ten Mile watershed because a large portion of the watershed in owned by one landowner.
TenMR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid and minimize impacts on unstable slopes, wetlands, floodplains and other areas of high habitat value.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
TenMR-NCSW-23.1.4.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, Lyme Timberland, Private Landowners	Use NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
TenMR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
TenMR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop a road management plan to lower maintenance costs and reduce sediment entering streams.	2	10	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.2.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	2	10	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-23.2.2.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, Lyme Timberland, Private Landowners	This action is part of ongoing road maintenance and should be directed at the entire road network.
TenMR-NCSW-23.2.2.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Lyme Timberland, Private Landowners	Cost should be considered part of land owner road management plans.
TenMR-NCSW-23.2.2.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
TenMR-NCSW-23.2.3.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFW, NRCS, RWQCB, USACE	
TenMR-NCSW-23.2.3.2	Action Step	Roads/Railroads	Encourage CalFire to increase enforcement oversight of THP erosion control measures.	3	100	CalFire, CDFW, NMFS	
TenMR-NCSW-23.2.4	Recovery Action	Roads/Railroads	Increase density, abundance, spatial structure, and diversity				
TenMR-NCSW-23.2.4.1	Action Step	Roads/Railroads	Fully implement the Ten Mile River TMDL.	2	10	RWQCB, EPA	The Ten Mile River does not have time lines specified. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for salmonid protection.
TenMR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
TenMR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
TenMR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with salmonid recovery needs.	2	25	County, CalFire, CDFW, NMFS	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration				
TenMR-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonids recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners, The Nature Conservancy, Trout Unlimited	The main benefit of this action is to improve flow conditions in the lower portion of the watershed where a few homes and limited agricultural use occurs.
TenMR-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development to the greatest extent practicable.	2	100	CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, Lyme Timberland, Private Landowners, RWQCB, The Nature Conservancy	Little infrastructure exists on the floodplains aside from numerous roads. Creation and restoration of offchannel habitat features could be used as a demonstration project and reference point for future actions in regards to costs, feasibility, biological effectiveness, and appropriate construction techniques. Areas in the lower reaches of the Ten Mile River should be designed with consideration of providing high flow refugia.
TenMR-NCSW-24.1.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
TenMR-NCSW-24.1.4.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, RWQCB, State Parks	Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting high risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat. Assess extent of high-risk shallow-seeded landslide areas and develop rehabilitation plan.
TenMR-NCSW-24.1.5	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TenMR-NCSW-24.1.5.1	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows.	3	100	CDFW, NMFS OLE, SWRCB	Some diversions are present in the lower portion of the watershed. All diversions should be closely evaluated during drought period to ensure minimal impact to rearing salmonids.
TenMR-NCSW-24.1.5.2	Action Step	Severe Weather Patterns	Work with stakeholders to implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	20	CDFW, NMFS, Private Landowners, SWRCB	
TenMR-NCSW-24.1.5.3	Action Step	Severe Weather Patterns	Develop critical flow values to be considered as the basis for minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	2	5	CDFW, NMFS, Private Landowners, SWRCB	
TenMR-NCSW-24.1.5.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for steelhead, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	3	100	CDFW, NMFS, Private Landowners, SWRCB	

Usal Creek Population

NC Steelhead Winter-Run

- Role within DPS or ESU: Potentially Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 1,100 adults
- Current Intrinsic Potential: 27.5 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The earliest known quantitative information on steelhead in Usal Creek was obtained from a report on fish rescue efforts initiated by CDFW in 1940 (Brown *et al.* 1994). Fish rescue efforts in 1945 (Shapovalov 1949) were directed at saving juveniles in response to stream dewatering during the late-summer/early-fall low flow period. In 1945 a total of 25,821 juvenile steelhead and 61,133 juvenile coho salmon were rescued from mainstem Usal Creek and possibly the estuary (a maximum distance of only 1.7 miles). The first quantitative sampling effort on record was conducted by CDFW in 1983 and consisted of a 30-meter sampling reach in North Fork Usal Creek. Sampling was conducted for the purpose of assessing juvenile salmonid presence and abundance (Harris 2010). No juvenile coho salmon were detected and juvenile steelhead abundance was low with a density of only 0.39 fish per square meter (f/m^2). CDFW conducted a more comprehensive effort in 1987 and sampled numerous tributaries[1] and found steelhead presence throughout all sampled reaches[2] (Harris 2010) although they did not estimate density. From 1993 to 2000, Georgia-Pacific Corporation continued the juvenile sampling effort[3] at three index reaches[4] and recorded juvenile steelhead densities ranging from a low of 0.19 f/m^2 (North Fork Usal in 2000) to a high of 2.6 f/m^2 (North Fork Usal in 1994) (Ambrose 2010). In 2008, CDFW initiated a three-year pilot study to evaluate monitoring methods for California's Coastal Salmonid Monitoring Plan, which included Usal Creek in the study design. This CDFW pilot study used a far more robust sampling method than previous juvenile sampling efforts. The pilot study was directed at obtaining estimates of adult abundance using a statistically rigorous

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[1] Sampled tributaries included reaches on North Fork Usal, South Fork Usal, Bear, Little Bear, and Julias creeks. Densities were not documented for the 1987 effort.

[2] No coho salmon were detected in 1987.

[3] Juvenile coho salmon were detected in South Fork Usal in 1993 and 1996 at very low densities.

[4] North Fork Usal, South Fork Usal, and Soldier creeks.

sampling design. Results from the 2008/2009 sampling year, based on a random sample of reaches, estimated only five steelhead (95 percent CI 1-12) adults spawned in the watershed (Gallagher and Wright 2009). Results from the 2009/2010 season, where six reaches were sampled, yielded an estimate of 31 (95 percent CI 11-51) spawning adults (D. Wright, Campbell Timber, personal communication, 2010).

Steelhead are likely distributed throughout all anadromous reaches of Usal Creek. On the North Fork a long cascade fall is present that precludes anadromous access to the majority of the upper North Fork watershed (D. Wright, Campbell Timber, personal communication, 2009). Areas of higher quality habitat exist in South Fork Usal and some of the tributaries where some higher quality instream habitat structure persists in discrete isolated patches.

History of Land Use

The predominant land use in the Usal Creek watershed is timber management, with a small recreation component with a State Parks campground located along the Usal Creek estuary. Timber management began in the Usal watershed in 1889, proceeding from the estuary up into the lower reaches of North Fork and South Fork Usal creeks. A sawmill and the town of Usal were located along the estuary, but were eventually abandoned by the early 1950s (Gertz 2005). The first phase of timber harvest ended in 1898, but later resumed in the late 1940s/early 1950s. The second wave of timber harvest is believed to be more destructive than the initial entry due to the advent of mechanized ground-based logging methods and increased road building. During the 1960s and 1970s, the old-growth redwood forests were completely removed, aside from a small number of isolated trees. Most timber was removed with ground-based yarding equipment that typically dragged logs down into riparian areas for staging on riparian landings. These logs were hauled out of the watershed over a large network of riparian roads. By the mid-1980s, with the removal of the old-growth forest, logging activities decreased down to the occasional timber harvest plan. In 1985 California State Parks established Sinkyone State Park at the former site of the Usal logging company and town site located adjacent to the Usal Estuary. Today the forest is in a period of recovery and the overstory has changed from a heavily dominated redwood overstory to a forest with young redwood and which now has a significant hardwood and Douglas-fir overstory component (R. Ballard, Campbell Timber, personal communication, 2009).

Current Resources and Land Management

The majority (98 percent) of the Usal watershed is privately owned, with Sinkyone State Park located in the lower portion of the watershed. Redwood Forest Foundation, Inc. (RFFI), a private nonprofit organization, is the major landowner in the watershed. RFFI purchased the Usal watershed from Hawthorne Timberland Management in 2007 and operates it as a multi-objective community-based forest with the goal of ensuring a sustained timber yield while restoring non-timber attributes on the forest. Only two private residences are located in the watershed and these are situated far from any fish bearing streams. To date, relatively few instream restoration projects have occurred on the forest (J. Ambrose, NMFS, personal observation, 1989-1999, 2009). Most restoration has focused on reducing sediment input from upslope roads, although some instream wood placement occurred in the South Fork in the early 1990s and a conifer release pilot project was initiated in the lower floodplain reaches of the North and South Fork in the mid-1990s. Many of the sediment reduction restoration efforts have occurred as part of timber harvest plans conducted in the watershed over the last 20 years. Little management of aquatic habitat and species occurs within the basin, except for irregular field habitat surveys conducted by CDFW and RFFI personnel as part of CDFW's coast wide monitoring effort.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: shelter rating, LWD frequency, estuary/lagoon quality and extent, and streamside road density. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Usal Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Usal Creek watershed are Poor within all sampled reaches. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat. Large portions of this functional instream structure were likely removed due to past land management and well-intentioned stream clearing practices.

Estuary: Quality and Extent

Available information obtained from historical photographs does not provide a clear image of the estuary's historical size and extent. Inferences, based on removal of old growth conifers from the floodplain and current rates of sediment input from the upper watershed, suggest the estuary may have provided more suitable rearing habitat for salmonids than occur under current conditions. Due to the importance estuaries play in the survival of steelhead, further assessment of the potential to enhance and restore estuarine quality and extent should be conducted.

Other Current Conditions

The original forest of Usal Creek was almost completely removed. The removal occurred relatively recently compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to Usal Creek watercourses. The alteration of sediment transport will likely continue to affect multiple steelhead lifestages in the watershed. The December 2006, Soldier Creek landslide will likely continue to contribute sediment into the watershed, and the transport of this sediment into the ocean will likely take many years under current conditions.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Usal Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Usal Creek CAP Results.

Roads and Railroad

Legacy roads from past logging and mining activity continue to impact the Usal watershed. Road densities are high throughout the watershed and are estimated at 3.5 miles of road per square mile overall and at 4.5 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed[5], not properly maintained, and many have been abandoned.

Severe Weather Patterns

The Usal Creek watershed exhibits a Mediterranean-type climate, with an average rainfall between 45 and 75 inches that falls predominantly between the months of October and April. Although winter and spring seasons can be relatively wet (especially within higher elevations), the summer and fall can be warm; however, the maritime influence results in many days of prolonged fog which moderates seasonal temperatures within the lower basin. Severe weather patterns, coupled with the existing road network, may exacerbate and accelerate future sediment delivery and land sliding.

Other Threats

No fish hatcheries operate within the Usal watershed, so hatchery-related effects are unlikely within the steelhead population. Similarly, invasive species are not known to be problematic

[5] The majority of these roads were constructed prior to the passing of the California Forest Practice Rules in 1973.

within the basin. Illegal marijuana cultivation is likely to occur in some of the drainages and has the potential to severely degrade juvenile rearing conditions by diverting water from streams and introducing toxic quantities of fertilizers and pesticides.

Fire, Fuel Management and Fire Suppression

Past logging resulted in a conversion of the conifer-dominated overstory to an overstory dominated by hardwoods in many areas. The combination of younger conifer and hardwoods likely leaves portions of the Usal Creek watershed more vulnerable to wildfire than under historical conditions. The remote location of the watershed may increase its vulnerability to large fire events due to potential delays in quickly responding to wildfire in Usal Creek.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Usal Creek watershed. Inadequate habitat complexity reduces rearing habitat availability, resulting in a decrease instream carrying capacity. Sediment input from upslope sources (*e.g.*, logging roads) can fill pools and decrease food availability in riffle habitats. Poor estuarine rearing conditions likely compound stresses to the juvenile lifestage, removing a critical environment for steelhead rearing from the watershed. Restoration actions should target addressing these issues within high potential stream reaches.

General Recovery Strategy

Improve Riparian Canopy Composition and LWD Volume

Much of the Usal Creek watershed would benefit from improved riparian composition and structure, which would improve LWD recruitment and increase instream shelter for juvenile fish. General practices to improve riparian condition include initiating a program of conifer release to promote existing conifer growth, particularly in the lower portions of North and South Fork Usal and the Usal mainstem. The lower reaches have a heavy alder overstory component that slows the growth of understory conifers and ultimately impedes the rate of future conifer recruitment to the wetted channel (J. Ambrose, NMFS, personal observation, 2009). An immediate program of LWD supplementation to enhance habitat complexity will likely be necessary due to the long period of time it will likely take for LWD to naturally recruit from existing riparian zones.

Address Upslope Sediment Sources

Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but a lot of work remains before this significant sediment source is thoroughly addressed. Of particular note, until recently the Usal County Road was poorly maintained by Mendocino County and contributed significant volumes of sediment into the North Fork. To the maximum extent practicable, problem roads and active erosion sites, such as the campground near Hotel Gulch on State Parks Property (see photo below), should be prioritized and addressed as part of a comprehensive sediment reduction plan for the entire Usal basin. The program should include a component that closes and remediates unnecessary roads and skid trails and moves campsites away from watercourses (see Figure 1) in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans is a top mitigation priority.

Picture 1: Campsite and roadway - upslope sediment sources within the Usal Creek watershed.

Improve Passage Conditions for Juvenile and Smolt Lifestages

Mainstem Usal Creek is highly aggraded and likely precludes juvenile movement out of the estuary into the upper tributaries in the fall. During drought conditions, smolt outmigration into the ocean is likely blocked due to dewatering in the late spring. Installing instream structures to more efficiently route sediment out of Usal, and therefore reduce the duration and extent of dewatering, should be examined.

Investigate and Address Current Estuary Conditions

The historical potential of the Usal Estuary is unknown; however, it is believed by many to be highly compromised due to aggradation from past land-management practices in the upper portion of the watershed. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the intrinsic potential of the estuary, within constraints of the existing geological context of the basin, to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved.

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NOAA FISHERIES
Usal Creek
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Waterfall Gulch
Chimney Rock
Bear
Little Bear
Usal Creek
Soldier
Hotel Gulch
Shady Dell
South Fork Usal
Julias
Sinkyone Wilderness State Park
Anderson Gulch
Dark Gulch
588 m
478 m
613 m
542 m
465 m
1000 ft
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
0
1
Miles

NC Steelhead Usal Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 25	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 25%	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	57.4% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	35.7% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 41.6	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 41.6	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% accessible	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	91.9% across IP-km (>70% average stream canopy)	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	66% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	75 to 89% IP-km (<20 C MWMT)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.85 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	of streams/ IP-km (>40% average primary pool frequency)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	57.4% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 25	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.117% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	18% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	>75% Intact Historical Species Composition	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	>3.5 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	4.3 Miles/Square Mile	Poor

NC Steelhead Usal Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture							
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low
3	Disease, Predation and Competition	Low				Low		Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching							
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development		Low	Low	Low	Low	Low	Low
12	Roads and Railroads	Low	Low	High	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	High	Medium	High
14	Water Diversion and Impoundments	Low	Low	Medium		Low	Low	Low

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat				
UC-NCSW-1.1.1.1	Action Step	Estuary	Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.	2	10	CDFW, State Parks	Efforts should be directed at facilitating channel scour as well as providing summer refugia for rearing juvenile salmonids in the estuary and the lower mainstem. Available information obtained from historical photographs does not provide a clear image of the estuary's historical size and extent. Inferences, based on removal of old growth conifers from the floodplain and current rates of sediment input from the upper watershed, suggest historically the estuary may have provided more suitable rearing habitat for salmonids than under current conditions. Due to the importance estuaries play in the survival of salmonids, further assessment of the potential to enhance and restore estuarine quality and extent should be conducted. An immediate program of LWD supplementation to enhance habitat complexity will likely be necessary due to the long period of time it will likely take for LWD to naturally recruit from existing riparian zones.
UC-NCSW-1.1.1.2	Action Step	Estuary	Evaluate and implement as appropriate, sediment removal from Usal lower mainstem and estuary. Sediment could be used as a rock source of the numerous unpaved roads in the watershed as well as for the Usal County Road.	2	5	CA Coastal Commission, CDFW, Mendocino County Department of Public Works, RFFI, State Parks	The historical potential of Usal estuary is unknown; however, it is believed to be highly compromised due to aggradation from past land-management practices in the upper portion of the watershed. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Excess sediment could be used as a rock source for the numerous unpaved roads in the watershed and for Usal County Road. The rock would likely need to be crushed, once removed from the estuary in order to provide an adequate road base.
UC-NCSW-1.1.1.3	Action Step	Estuary	Enhance and restore estuary function by improving complex habitat features.	2	10	CA Coastal Commission, CDFW, Mendocino County, State Parks, NOAA RC	
UC-NCSW-1.1.1.4	Action Step	Estuary	Encourage State Parks to fund and implement restoration actions that benefit CCC coho and NC steelhead and other special status species in the lagoon. Requirements and goals will vary by species.	2	30	State Parks	Actions may include installing habitat forming features such as large wood to increase scour and provide refugia for down migrants.
UC-NCSW-1.1.2	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone				
UC-NCSW-1.1.2.1	Action Step	Estuary	Conduct conifer release by thinning hardwoods in lower reaches of South and North Fork Usal Creek. Conifers could serve as a source for future large woody debris recruitment into the estuary and aid in cooler water temperatures flowing into estuary.	2	5	RFFI	

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-1.1.2.2	Action Step	Estuary	Initiate riparian planting of conifers within the riparian zones that are currently dominated by hardwoods and floodplain areas that are absent of conifers.	2	5	CDFW, Lyme Timberland, State Parks	Initial efforts should focus on the alder dominated riparian areas along the mainstem and lower North and South Forks of Usal Creek. Historical photographs of the Usal floodplain indicate the presence of old growth conifers. Replanting the floodplain would likely facilitate LWD recruitment in the distant future.
UC-NCSW-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**				
UC-NCSW-1.2.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events				
UC-NCSW-1.2.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	10	State Parks	Additional educational signage along the estuary should be included with this recommendation. Signage should explain estuarine function and its benefits to endangered species and water quality of a properly functioning estuary.
UC-NCSW-1.2.1.2	Action Step	Estuary	Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to Usal lagoon.	3	10	CDFW Law Enforcement, NMFS OLE, State Parks	Unauthorized breeching reported during smolt season.
UC-NCSW-1.2.1.3	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.	3	100	State Parks	
UC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
UC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Create flood refuge habitat (e.g., create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats), and hydrologically connected floodplains with riparian forest.	1	10	CDFW, NOAA RC, RFFI, State Parks	Areas with perennial flow and high IP-km scores should be targeted first for this measure. Little infrastructure exists on the floodplain. Creation and restoration of off-channel habitat features could be used as a demonstration project and reference point for future actions in regards to costs, feasibility, biological effectiveness, and appropriate construction techniques. Areas in the lower reaches of Usal should be designed with consideration of providing high flow refugia.
UC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFW, RFFI, State Parks	Assessments have already been conducted but additional site specific field checks and mapping are likely needed.
UC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter baseflow and flood stage.	3	20	CDFW, NOAA RC, RFFI, State Parks	
UC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Replant floodplain with native overstory vegetation.	2	20	CDFW, RFFI, State Parks	
UC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-5.1.1	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)				
UC-NCSW-5.1.1.1	Action Step	Passage	Evaluate smolt (and juvenile rearing) outmigration constraints, particularly during drought year low flow conditions, through the aggraded estuary, mainstem Usal, and lower reaches of N Fk. Usal.	2	10	RFFI, State Parks	Evaluation should consider flow conditions and impacts to smolt outmigration under extreme drought conditions through the month of June.
UC-NCSW-5.1.1.2	Action Step	Passage	Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season..	1	5	CDFW, NMFS, RFFI, State Parks	Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season.
UC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
UC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	10	CDFW, NMFS, RFFI, State Parks	
UC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install Large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	5	CDFW, NMFS, RFFI, State Parks	Usal Creek has approx. 5 km of High IP habitat. Data from CDFW habitat inventories indicate shelters throughout the Usal Creek watershed are poor within all sampled reaches. Initial efforts should be directed at the lower reaches where significant aggradation limits summer rearing habitat. Unsecured LWD input is practical in Usal Creek because almost no downstream infrastructure is present other than the County bridge which is recommended in this plan for upgrades. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document.
UC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Mechanically recruit alder from floodplain surfaces into the stream channel.	2	5	, CDFW, RFFI, State Parks	Recruit alders at least 20 feet away from the stream banks to maintain bank integrity. Rather than felling trees by chainsaw, pull over with winches and place root balls in the channel. Recruit at a rate of one tree per channel width in the lower portions of North Fork and South Fork Usal and appropriate locations on the mainstem. This action should occur within the context of a larger overall large wood (conifer) enhancement effort throughout the watershed.
UC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Identify historical steelhead habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	15	CDFW, NMFS, RFFI, State Parks	Increasing channel confinement should be a priority in the lower portion of Usal Creek. A confined channel would more efficiently sort and process bed material and thus, facilitate development of resilient pool riffle structure.
UC-NCSW-6.1.1.5	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CDFW, NMFS, RFFI, State Parks	Little bank hardening is anticipated to be needed in Usal watershed.
UC-NCSW-6.1.1.6	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	CDFW, Private Landowners	This recommendation should be adopted as a reoccurring recommendation for all timber harvest plans.
UC-NCSW-6.1.1.7	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody material for all historical anadromous salmonid rearing habitats in Usal Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CDFW, NMFS, State Parks	Manipulation of Large Woody Material should not occur until evaluated by a hydrologist and/or qualified biologist familiar with Lost Coast streams.
UC-NCSW-6.1.1.8	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	3	100	CDFW, RFFI, RWQCB, State Parks	Significant oversight and evaluation should occur prior to removal of any large wood structure.
UC-NCSW-6.1.1.9	Action Step	Habitat Complexity	Conserve and manage forestlands for older forest stages.	3	25	CDFW, RFFI, RWQCB, State Parks	

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-6.1.1.10	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	100	RFFI, State Parks	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. The forest is in a period of recovery from past intensive harvest practices and the overstory has changed from a heavily dominated redwood overstory to a forest with young redwood and a significant hardwood and Douglas-fir overstory component. Conifer release will ultimately restore riparian processes by providing a source for future large wood recruitment into watercourses.
UC-NCSW-6.1.1.11	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	3	50	RFFI, State Parks	
UC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools				
UC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Excavate sediment and build up channel bars.	2	10	CDFW, RFFI, State Parks, USACE	Using an excavator/backhoe, remove sediment from incipient pools or adjacent to incipient bars, and place the sediment on incipient bars. Grade the placed sediment to contoured form and attach to banks, mimicking alternate bars in general shapes. Bars should confine the active channel approximately 50% in width. This rough design estimate should be refined by results from field survey and hydraulic model analysis. Place LWD and available coarse sediment on bar surfaces to increase resistance to erosion.
UC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-8.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment				
UC-NCSW-8.1.1.1	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	The original forest of Usal Creek was almost completely removed. The removal occurred relatively recently compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to Usal Creek watercourses. The alteration of sediment transport will likely continue to affect multiple salmonid life stages in the watershed. The December 2006, Soldier Creek landslide will likely continue to contribute sediment into the lower watershed, and the transport of this sediment into the ocean will likely take many years under current conditions.
UC-NCSW-8.1.2	Recovery Action	Sediment	Improve instream gravel quality				
UC-NCSW-8.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	30		

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-8.1.2.2	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	10	, CDFW, IWRP, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	
UC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
UC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, RFFI	
UC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, RFFI	
UC-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, RFFI	
UC-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, RFFI	
UC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
UC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by fire fighting actions.	2	100	CalFire	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
UC-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)				
UC-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, storage tanks, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire	Do not draft water from the lagoon during fire unless absolutely necessary.
UC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**				
UC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
UC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	2	CalFire, NMFS	
UC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
UC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, RFFI	These will likely be replaced as part of future timber harvest plans in Usal watershed. Action is considered In-Kind
UC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	30	Lyme Timberland, Mendocino County Department of Public Works, RFFI, State Parks	Some upgrades on RFFI lands have already occurred. The long-term benefits that would result from this recommendation should be carefully evaluated against the possibility of short term increases in sedimentation and turbidity.

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
UC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	Mendocino County Department of Public Works, RFFI, State Parks	Legacy roads from past logging activity continue to impact the Usal watershed. Road densities are high throughout the watershed and are estimated at 3.5 miles of road per square mile overall and at 4.5 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed, not properly maintained, and many have been abandoned.
UC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Encourage County of Mendocino to winterize the Usal County road using modern techniques to ensure sediment from roads does not enter North Fork Usal Creek.	2	100	CDFW, Mendocino County Department of Public Works, RFFI	The Usal County Road should be properly winterized every year to ensure sediment from this dirt road does not enter Usal Creek or other anadromous streams in the area. Road closure during the winter period should be implemented if necessary to ensure integrity of road winterization efforts.
UC-NCSW-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	This should be an ongoing program (approximately every three years), particularly for County road maintenance staff regarding sediment remediation on the Usal County Road. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input.
UC-NCSW-23.1.2.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	20	Lyme Timberland, Mendocino County Department of Public Works, RFFI, State Parks	However, a longer duration is associated with the action due to the large road and skid trail network and low rate of timber harvest. North Fork Usal's mainline riparian road should be considered one of the top decommission priorities.
UC-NCSW-23.1.2.5	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	Of particular note, the Usal County Road is poorly maintained by Mendocino County and is believed to contribute significant volumes of sediment into the North Fork. To the maximum extent practicable, problem roads and active erosion sites, such as the campground near Hotel Gulch on State Parks Property, should be prioritized and addressed as part of a comprehensive sediment reduction plan for the entire Usal basin. The program should include a component that closes and remediates unnecessary roads and skid trails and moves campsites away from watercourses in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules.

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from steelhead streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	2	5	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.1.2.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	Mendocino County Department of Public Works, RFFI, State Parks	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Number of energy dissipaters will be identified from road assessment.
UC-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
UC-NCSW-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid and minimize impacts on unstable slopes, wetlands, floodplains and other areas of high habitat value.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
UC-NCSW-23.1.4.1	Action Step	Roads/Railroads	Replace the existing bridge on Usal County Road located in the Sinkyone State Parks Campground.	2	5	Mendocino County, State Parks	Due to stream bed aggradation the current bridge likely cannot pass a 100 year flow event in Usal Creek. Protection of this inadequate crossing in a major concern that may preclude necessary instream LWD enhancement above the bridge.
UC-NCSW-23.1.4.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	Use NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
UC-NCSW-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure				
UC-NCSW-23.1.5.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	Many abandoned roads and active roadside areas have extensive infestations of pampas grass.
UC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
UC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road construction/density, dams, etc.)				
UC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFW, NRCS, RWQCB, USACE	This should be considered a standard practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
UC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Work with stakeholders to develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	RFFI	A lower priority due to the projected low rate of timber harvest actions in the watershed in the immediate upcoming years resulting in a subsequent lack of road construction/reconstruction. A suitable plan for this watershed may incorporate a road sediment reduction plan as part of the future harvest planning scenario.
UC-NCSW-23.2.1.3	Action Step	Roads/Railroads	For all dirt roads, apply (at a minimum), the road standards outlined in the California Forest Practice Rules.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	This recommendation is specifically directed at the County of Mendocino for the Usal County Road and State Parks for the Sinkyone Campground at Usal Beach. Action is considered In-Kind
UC-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
UC-NCSW-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
UC-NCSW-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-23.2.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	2	20	Mendocino County Department of Public Works, RFFI, State Parks	This is a feasible recommendation for the Usal watershed due to the large number of abandoned and poorly maintained roads. Many of these roads are historical logging roads and skid trails that are no longer used. Decommissioning should evaluate potential impacts and benefits in terms of sediment mobilization between leaving road in current conditions and reopening for decommissioning purposes.
UC-NCSW-23.2.3.2	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.2.3.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.2.3.5	Action Step	Roads/Railroads	Encourage County of Mendocino to address sediment input from the Usal County road into Waterfall Gulch (tributary to North Fork Usal).	2	20	CDFW, Mendocino County Department of Public Works, NMFS, RFFI, State Parks	The Usal County Road should be properly winterized every year to ensure sediment from this dirt road does not enter Usal Creek or other anadromous streams in the area.
UC-NCSW-23.2.3.6	Action Step	Roads/Railroads	Use excess gravel in the Usal Estuary as a source of road rock material in the watershed including the Usal County Road.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	Rock from the estuary will need to be crushed to increase adhesion and some limited infrastructure will be needed for crushing.
UC-NCSW-23.2.4	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
UC-NCSW-23.2.4.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific road management plan is created and implemented.	2	20	County of Mendocino, RFFI, State Parks	
UC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)				
UC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	10	FEMA, Mendocino County, State Parks, USACE	
UC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration				
UC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead.	3	10	CalFire, CalTrans, CDFW, NMFS, RFFI, RWQCB, SWRCB	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
UC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
UC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development to the greatest extent practicable.	1	100	CDFW, County, RFFI, State Parks	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc.
UC-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Evaluate and implement restoration or creation of offchannel habitats and backwater alcoves on the lower Usal floodplain.	2	15	CDFW, NMFS, RFFI, State Parks	Little infrastructure exists on the floodplain.
UC-NCSW-24.1.4	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment				

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-24.1.4.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalFire, RFFI, RWQCB, State Parks	Usal Creek watershed exhibits a Mediterranean-type climate, with an average rainfall between 45 and 75 inches that falls predominantly between the months of October and April. Although winter and spring seasons can be relatively wet (especially within higher elevations), the summer and fall can be warm; however, the maritime influence results in many days of prolonged fog which can moderate seasonal temperatures within the lower basin. Severe weather patterns, coupled with the existing road network, may exacerbate and accelerate future sediment delivery and land sliding.
UC-NCSW-24.1.4.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, RFFI, RWQCB, State Parks	Assess and prioritize high-risk shallow-seeded landslide and develop plan to rehabilitate.
UC-NCSW-24.2	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
UC-NCSW-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize increased landscape disturbances				
UC-NCSW-24.2.1.1	Action Step	Severe Weather Patterns	Minimize additional development on the lower Usal floodplain.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	

Wages Creek Population

NC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Northern Central Coastal
- Spawner Abundance Target: 700 adults
- Current Intrinsic Potential: 17.4 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Quantitative information on steelhead abundance in Wages Creek was obtained from juvenile fish sampling efforts initiated by CDFW in 1988[1]. The sampling effort consisted of a 30-meter sampling reach in Wages Creek on October 24, 1988. More juvenile coho salmon were detected than juvenile steelhead, likely due to an outplanting effort by CDFW earlier in the year. Subsequent sampling was conducted most years from 1989 through 2002 by CDFW and Georgia-Pacific Corp., and yielded estimates of steelhead juvenile density ranging from 0.50 fish per meter square (f/m^2) to 0.07 f/m^2. In 1995, CDFW began a three-year program of heavily planting the lower portion of Wages Creek with thousands of juvenile coho salmon in an effort to reestablish coho salmon into the watershed. As part of this effort an outmigrant trap was operated in lower Wages Creek in 1999 (www.krisweb.com/kristenmile) to evaluate the smolt densities the following spring. Trapping results documented 877 (one-year-old or older) smolts outmigrating from the watershed and 1107 young-of-the-year steelhead juveniles. In 2008, CDFW initiated a three-year pilot study to evaluate monitoring methods for California's Coastal Salmonid Monitoring Plan, which included Wages Creek in the study design. This CDFW pilot study used a far more robust sampling method than previous juvenile sampling efforts and was directed at obtaining estimates of adult abundance using a statistically rigorous sampling design. Results from the 2009/2010 sampling year, based on a random sample of reaches in Wages Creek, estimated 35 steelhead adults spawned in the watershed (D. Wright, Campbell Timber, personal communication, 2010). Under current conditions, steelhead are likely distributed throughout all anadromous reaches of Wages Creek, the sole exceptions being high-gradient headwater streams and areas upstream of migration barriers.

[1] http://www.krisweb.com/

History of Land Use

The predominant land use within the Wages Creek watershed is timber management, with limited residential housing located along the lower reaches of Ryder Gulch and lower mainstem Wages. These lower reaches are floodplain areas and were cleared of the overstory canopy for grazing and farming purposes. At least one sawmill was located in Wages Creek at Ryder Gulch, where the creek was dammed to form a log pond (Figure 1). The first logging entry into the watershed began in approximately the later 1800s. At the mouth of Wages Creek is a privately owned campground which encompasses the Wages Creek estuary.

Picture 1: Ryder Gulch mill and mill pond circa 1889-1893. Ryder Gulch is a tributary to Wages Creek. Image courtesy of Mendocino County Historical Society.

Current Resources and Land Management

The entire Wages Creek watershed is privately owned, with Hawthorne Timberland Management owning the largest proportion. Private residences are located in the lower watershed. To date, relatively few instream restoration projects have occurred in Wages Creek, with most restoration actions being focused on reducing sediment input from upslope roads associated with timber management. Little management or evaluation of aquatic habitat and species occurs within the basin, except for irregular field habitat surveys conducted by CDFW personnel as part of CDFW's coast wide monitoring effort.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, riparian vegetation, and sediment transport. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Wages Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Wages Creek watershed are poor within all sampled reaches. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat. Large portions of this functional instream structure were likely removed due to past land management and well-intentioned but often misguided stream clearing practices. Inadequate instream habitat complexity is believed a major stressor for the adult, summer rearing, winter rearing, and smolt lifestages.

Other Current Conditions

The original old growth forest of Wages Creek has been completely removed, aside from some scattered residual trees. The final removal occurred relatively recently, compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to the watercourses. The alteration of sediment transport will likely continue to affect multiple lifestages of steelhead in the watershed.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Wages Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Wages Creek CAP Results.

Roads

Legacy roads from past logging and mining activity continue to impact the Wages watershed. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile overall and at 5.3 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed[2], not properly maintained, and many have been abandoned.

Other Threats

No fish hatcheries operate within the Wages watershed, so hatchery-related effects are unlikely within the steelhead population. Similarly, invasive species are not known to be problematic within the basin. Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. General estuary conditions are unknown but should be investigated in the future. NMFS is aware of unsubstantiated reports regarding unauthorized fishing in the estuary, which may impact rearing juveniles during the summer period.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Wages Creek watershed. Inadequate habitat complexity reduces rearing habitat availability, resulting in a decrease in stream carrying capacity. Sediment input into Wages Creek has accelerated over the past several decades due to upslope land disturbance, likely resulting in pools becoming filled and food availability decreasing in riffle habitats. Restoration actions should target addressing these issues within high potential stream reaches.

General Recovery Strategy

Improve LWD volume

Most of the Wages Creek watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. An immediate LWD supplementation program to enhance habitat complexity will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones.

Address Upslope Sediment Sources

Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly

[2] The majority of these roads were constructed prior to the passing of the California Forest Practice Rules in 1973.

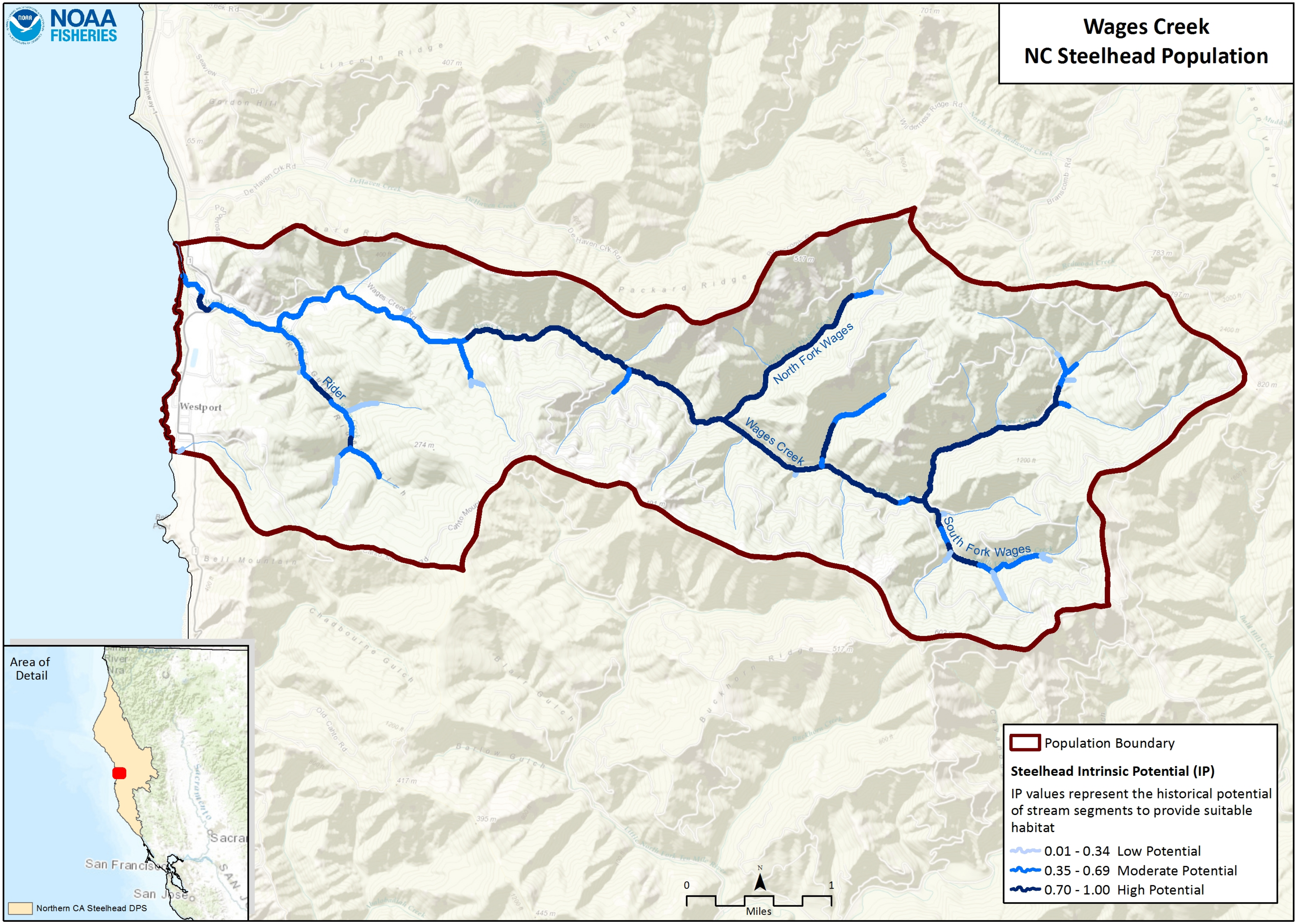
addressed. The program should include a component that closes and remediates unnecessary roads and skid trails, lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

Investigate and Address Current Estuary Conditions

The historical potential of the Wages Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved.

Literature Cited

Bond, M. H., S. A. Hayes, C. V. Hanson, and B. R. MacFarlane. 2008. Marine Survival of Steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. Canadian Journal of Fisheries and Aquatic Sciences 65:2242-2252.


Wages Creek
NC Steelhead Population
NOAA FISHERIES
Westport
Wages Creek
North Fork Wages
South Fork Wages
Rider
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles
N

NC Steelhead Wages Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	36% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17.1% (0.85mm) and >33.7% (4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.5 diversions per 10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	100% streams with canopy >80% canopy as of survey from 1996	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	36% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	>90% IP-km (<20 C MWMT)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.30 Fish/m2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	36% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.5 diversions per 10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.197% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	29% of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	>75% Intact Historical Species Composition	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	4.1 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.3 Miles/Square Mile	Poor

NC Steelhead Wages Creek CAP Threat Results

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific-threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low
3	Disease, Predation and Competition	Low	Low	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Medium		Medium		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Low	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Low	Medium	Low	High	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Medium	Medium	Low	Medium

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
WgC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical complex habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CA Coastal Commission, CDFW, Private Landowners	The historical potential of the Wages Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Due to various constraints, the overall habitat potential is likely relatively small.
WgC-NCSW-1.1.1.2	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	5	CDFW	
WgC-NCSW-1.1.1.3	Action Step	Estuary	Restore estuary function by reducing fine sediment input from the upper watershed.	2	50	CA Coastal Commission, CDFW, Private Landowners	Refer to road strategy recommendations.
WgC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
WgC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	3	10	CDFW, Private Landowners, Trout Unlimited	
WgC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Private Landowners, Trout Unlimited	
WgC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelter ratings				
WgC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity.	2	20	Lyme Timberland	Wages Creek has been habitat typed and areas lacking in pool habitats are known.
WgC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	CalFire, CalTrans, Lyme Timberland, CDFW, Mendocino County, Private Landowners, RWQCB, USACE	Some landowners in the lower portions of Wages Creek may be concerned about potential property impacts associated with large wood materials adjacent to their infrastructure.
WgC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	25	Mendocino County RCD	
WgC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency				
WgC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	100	Lyme Timberland	Promoting growth could include such actions as riparian permanent retention strategies of larger diameter trees and/or conifer release strategies, particularly in areas dominated by hardwoods.
WgC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, PG&E, Private Landowners, RPFs	
WgC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	CalFire, CDFW, Lyme Timberland, Private Landowners	Costs may be higher in Wages Creek than in some of the other watersheds in the Lost Coast Diversity Stratum due to the presence of rural residences in the lower portion of the watershed. Due to the presence of these structures, additional engineering may be required. Low gradient floodplain areas should be initially target for restoration.

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-6.1.2.4	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	Lyme Timberland	Initial focus should be directed at lower floodplain areas. This strategy would provide benefits to steelhead as well as coho salmon. Due to presence of some infrastructure in the area, the plan should carefully evaluate potential impacts of wood mobilization during high flow events.
WgC-NCSW-6.1.2.5	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	20	Lyme Timberland, RPFs	NMFS programmatic biological opinion with the Corps and NOAA RC should be used to minimize permitting delays.
WgC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
WgC-NCSW-7.1.1.1	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	2	10	CalFire, Lyme Timberland, Private Landowners	Most of the Wages Creek watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with small landowners in the floodplain to increase riparian buffer widths and initiating planting of native vegetation. An immediate LWD supplementation program to enhance habitat complexity will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones.
WgC-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	100	Lyme Timberland, Private Landowners	This practice would have major benefits if implemented in the lower floodplain where numerous small landowners live.
WgC-NCSW-7.1.1.3	Action Step	Riparian	Plant native vegetation in lower Wages and Rider Gulch to promote streamside shade.	3	10	CDFW, NRCS, RWQCB	
WgC-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
WgC-NCSW-7.1.2.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
WgC-NCSW-8.1.1.1	Action Step	Sediment	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching salmonid streams (CDFG 2004).	3	10	CalFire, Lyme Timberland, Private Landowners, RWQCB	
WgC-NCSW-8.1.1.2	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	10	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, Lyme Timberland	
WgC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	CalFire, Lyme Timberland	
WgC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
WgC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFW, NMFS, USFWS	

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)				
WgC-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, Lyme Timberland	Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
WgC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
WgC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
WgC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	1	CalFire, NMFS	
WgC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
WgC-NCSW-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
WgC-NCSW-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	3	10	CalFire, CDFW, Lyme Timberland, RWQCB	
WgC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
WgC-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, California Geological Survey, Lyme Timberland, Private Landowners	
WgC-NCSW-19.1.3.2	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	100	CalFire, CDFW, RPFs, RWQCB	
WgC-NCSW-19.1.3.3	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
WgC-NCSW-19.1.4.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
WgC-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	25	CalFire, Lyme Timberland, CDFW, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
WgC-NCSW-19.1.6.1	Action Step	Logging	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
WgC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-19.2.1.1	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, Lyme Timberland, Mendocino County, Private Landowners	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
WgC-NCSW-19.2.1.2	Action Step	Logging	Discourage rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners	
WgC-NCSW-19.2.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	2	40	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.2.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-19.2.2.1	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey, Lyme Timberland, RPFs	
WgC-NCSW-19.2.2.2	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.2.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse.	2	100	CalFire, California Geological Survey, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	Lyme Timberland, Mendocino County, Private Landowners	Legacy roads from past logging activity continue to impact the Wages watershed. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile overall and at 5.3 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed , not properly maintained, and many have been abandoned.
WgC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	3	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	10	CalFire, Lyme Timberland, RWQCB	Abandoned riparian roads in the upper portion of mainstem Wages should be closely evaluated for decommissioning. The original old growth forest of Wages Creek has been completely removed, aside from some scattered residual trees. The final removal occurred relatively recently, compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to the watercourses. The alteration of sediment transport will likely continue to affect multiple life stages of NC steelhead in the watershed.
WgC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so materials from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Lyme Timberland, Private Landowners, RWQCB	

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
WgC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	25	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
WgC-NCSW-23.1.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas.	3	20	CalFire, CDFW, Lyme Timberland, Private Landowners	Initial focus should be directed in steeper portions of the upper watershed. Active and abandoned logging roads and skid trails exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality. This is a feasible recommendation for the Wages Creek watershed due to the fact most of the watershed is in timber management and owned by only a few landowners. The program should include a component that closes and remediates unnecessary roads and skid trails, lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery.
WgC-NCSW-23.1.3.2	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	2	5	Lyme Timberland	
WgC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**				
WgC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Lyme Timberland, Private Landowners	This is part of ongoing maintenance requirements. Correct conditions that are likely to deliver sediment to streams, otherwise roads will be hydrologically closed/disconnected (fills and culverts removed, natural hydrology of hillslope largely restored).
WgC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Apply forest practice rules road winterization standards to all roads in the watershed.	2	20	CalFire, Lyme Timberland, Private Landowners	This action step will require outreach to smaller landowners in the lower portion of the watershed for effective implementation.
WgC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-23.2.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	CalFire, California Geological Survey, Lyme Timberland, Private Landowners	
WgC-NCSW-23.2.1.5	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CalFire, California Geological Survey, CDFW, Lyme Timberland, Mendocino County, RWQCB	
WgC-NCSW-23.2.1.6	Action Step	Roads/Railroads	Develop and implement a specific road management plan. A plan should be developed within the next 10 years. The plan should identify areas of high threat and develop recommendations to mitigate or remediate the impacts.	2	20	CalFire, California Geological Survey, CDFW, Lyme Timberland, Mendocino County, RWQCB	

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
WgC-NCSW-23.2.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Lyme Timberland	
WgC-NCSW-23.2.2.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	20	Lyme Timberland	
WgC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology				
WgC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	1	20	CDFW, Private Landowners, SWRCB	
WgC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids.	3	10	CalFire, Lyme Timberland, CDFW, Private Landowners, RWQCB, SWRCB	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
WgC-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonid recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of steelhead (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners	
WgC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, California Geological Survey, Lyme Timberland, RWQCB	These areas should be identified and efforts should be made to minimize disturbance leading to increased risk of mobilization.
WgC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
WgC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	30	CalFire, FEMA, Lyme Timberland Mendocino County	
WgC-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalFire, Lyme Timberland, Mendocino County, Private Landowners	

NC Steelhead DPS Rapid Assessment Profile: North-Central Coastal Diversity Stratum Populations

Cottaneva Creek

- Role within DPS: Potential Independent Population
- Spawner Abundance Target: 129-261 adults
- Current Intrinsic Potential: 21.9 IP-km

Pudding Creek

- Role within DPS: Potentially Independent Population
- Spawner Abundance Target: 141– 285 adults
- Current Intrinsic Potential: 23.9 IP-km

Albion River

- Role within DPS: Independent Population
- Spawner Abundance Target: 290-581 adults
- Current Intrinsic Potential: 48.6 IP-km

Abundance and Distribution

In these watersheds steelhead are present in variable numbers and widely distributed. The type of data and quality of data vary by watershed and by year. Of the three, Pudding Creek is the most intensively monitored due to a salmonid lifecycle monitoring program which has been in operation for over ten years and is run by Campbell Timberland Management. Mean estimates of adult abundance in Pudding Creek, based primarily on redd counts, have ranged between 10 in 2008/9 to >525 in 2003/4 (AUC Estimate) (Gallagher 2005; Gallagher and Wright 2008). In 2011, smolt abundance was estimated to total 14,284 (SE = 1,457) individual fish (Gallagher and Wright 2012). The first juvenile sampling was initiated in 1988 by CDFW, and then began on a more-or-less yearly basis in 1993 to present. Density estimates have varied considerably, depending on site sampled and year, but in all years steelhead juveniles were successfully detected (D. Wright, Campbell Timber, personal communication, 2013).

Mean estimates of adult abundance in the Albion River have generally been conducted through redd counts as part of CDFW's coastal Mendocino County salmonid life cycle and regional status and trends monitoring effort. The Albion sampling effort is part of a larger regional sampling program and estimates are therefore not specifically derived to estimate the greater Albion River steelhead population. In 2008/9, eight steelhead adults (0-22) were estimated, in 2009/10 no adults were estimated, and in 2010/11 at total of 19 adults (0-126) were estimated (Gallagher and Wright 2012). Juvenile sampling has occurred sporadically since the late 1980s.

Aside from sporadic estimates of summer juvenile abundance, relatively little sampling has occurred in Cottaneva Creek. Cottaneva Creek is included in the overall suite of streams sampled in CDFW's coastal Mendocino County salmonid life cycle and regional status and trends monitoring effort but like the Albion River population, the sampling effort is part of a larger regional sampling program and estimates are, therefore, not specifically derived to estimate the greater Albion River steelhead population. In 2008/9, 2009/10, and 2010/11 one reach was sampled and no redds were detected (Gallagher and Wright 2012).

History of Land Use, Land Management and Current Resources

The historic land use in the three watershed is largely defined by timber harvest, which generally began in the latter 1800s/early 1900s. Railroads were constructed in the three watersheds and timber was harvested and transported to sawmills at Rockport (Cottaneva Creek), Glenblair and Fort Bragg (Pudding Creek), or Albion Harbor (Albion River). Rate of timber harvest varied between the watershed but by the 1970s all of the original forest in all three watersheds had been harvested and the forests were in their second harvest rotation. In general, the Albion River watershed was less intensely harvested than either Pudding or Cottaneva creeks and maintains some of the better stocked forest stands in private ownership in Mendocino County. Both Pudding and Cottaneva creeks were subjected to extensive even-aged management of their second growth forest (J. Ambrose, NMFS, personal communication, 2013).

The lower Albion River estuary was modified with the construction of sawmills, planning mills, *et cetera* which operated until 1928 and now has a small boat harbor and 22 acre campground. The Albion River estuary, unlike many other estuaries in the Diversity Stratum remains open year-round and tidal influence extends as much as five miles upstream (Downie *et al.* 2004). The majority of the Pudding Creek estuary was inundated after the construction of the Pudding Creek dam where waters of Pudding Creek and the Noyo River were impounded for diversion to the Union Lumber Mill in Fort Bragg. A sawmill was located adjacent to the Cottaneva estuary and operated sporadically until the mid-1950s.

The human population in Pudding Creek is approximately 2,307 people but habitat in the watershed is generally located at the top of southern ridge line or on the marine terrace in the City of Fort Bragg. Cottaneva Creek is sparsely populated with a total of 23 people. The total Albion River basin population is about 912 people, with many of the population located around the small hamlets of Albion and Comptche.

Diversity Stratum Population and Habitat Conditions

Impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on these conditions is abated. The majority of conditions evaluated for the three watersheds were rated as Good for most lifestages. Overall, the Cottaneva, Pudding, and Albion watersheds are subject to fewer conditions than many other watersheds in the Diversity Stratum due to a singular land use (timber harvest) and a general lack of urban or rural residential impacts.

The following discussion focuses on those conditions that were rated as Poor or Fair for steelhead life history stages (see "North-Central Coastal Diversity Stratum" Rapid Assessment). These were: Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and functioning watershed processes.

Estuary: Quality and Extent

Estuary conditions are rated as Fair and have moderate effects on the target lifestages, due in large part to the altered conditions of the Pudding Creek estuary and generally unsuitable summer rearing conditions due to poor water quality. The other two estuaries, while somewhat impaired due to existing infrastructure, are less impacted than many other similar habitats in the DPS.

Hydrology: Baseflow and Passage Flows

Hydrology: Baseflow and Passage Flows was rated as Fair and has moderate effects to the summer rearing lifestages, primarily due to ongoing water diversions in the Albion River watershed near the town of Comptche.

Habitat Complexity: Large Wood and Shelter

Lack of habitat complexity in the form of wood and high levels of instream sediment resulted in a Fair rating and is having a moderate adverse effect on the adult, summer, and winter rearing lifestages. Lack of instream complexity is likely the result of long term land uses related to timber harvest in the three watersheds, particularly impacts associated with mechanized logging practices prior to the California Forest Practice Rules and removal of wood during the 1970s-1980s. Of reaches sampled in the three watersheds, data from CDFW habitat inventories indicate large wood is lacking. However, since these surveys were conducted, extensive efforts to improve instream habitat conditions have been conducted in portions of all three streams. While significant efforts have occurred, it is likely that instream habitat conditions overall are not at the viability targets for these attributes. Threats that have caused, are causing, or may cause this condition to continue to impair steelhead life history targets include Logging, Fire and Fuel Management, and Roads/Railroads.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Impaired gravel quality and quantity had a major adverse effect (Poor rating) on the egg lifestage, and is potentially limited for that lifestage. This factor is rated as Fair and has had a moderate effect on the adult and summer and winter rearing lifestages. These ratings reflect the generally high sediment loads throughout the three watersheds in particular and the Diversity Stratum in general. Threats that may cause this condition to continue to impair steelhead life history targets include Logging, Fire and Fuel Management, and Roads/Railroads.

Viability: Density, Abundance and Spatial Structure

Viability: Density, Abundance and Spatial Structure is rated as Fair and has had a moderate effect on the target lifestages. Steelhead populations are depressed in the three watersheds but all three populations maintain juvenile steelhead presence and distribution throughout the mainstems and tributaries.

Water Quality: Turbidity or Toxicity

Turbidity is rated as Fair and has had a moderate effect on adults, wintering juveniles, and smolts. Sources of increased turbidity are the result of high rates of fine sediment input from upslope areas throughout the three watersheds.

Threats

The following discussion focuses on those threats that were rated as Poor or Fair (see "North-Central Coastal Diversity Stratum" Rapid Assessment). Recovery strategies focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in "North-Central Coastal Diversity Stratum" Rapid Assessment.

Fire, Fuel Management and Fire Suppression

This threat is rated as Poor and is considered a major contributor to the conditions Habitat Complexity: LWD and Sediment: Gravel Quality and Distribution of Spawning Gravels due to a fire reducing potential sources of future LWD recruitment and potentially increasing the rate of fine sediment input into spawning gravels following runoff in response to winter rainfall events. Increased rates of sedimentation are typical, and in combination with past and ongoing sources of sediment input, could significantly impact gravel quality and quantity necessary for successful spawning and food production. According to CalFire data, some areas in the Cottaneva and Albion watersheds have High fire hazard rating. A major fire, particularly if located in areas with High erosion hazard rating could result in major increases in fine sediment and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures would likely result.

Logging and Wood Harvesting

Timber harvest is rated as Poor and remains a major contributor to two conditions for steelhead in all three watersheds, but at diminished levels compared to historical practices. It is considered a major contributor to the conditions of Habitat Complexity: Large Wood and Shelter; and Sediment: Gravel Quality and Distribution of Spawning Gravels. Even with application of new California Forest Practice Rules, this threat is anticipated to continue into the foreseeable future. Rates of timber harvest are particularly high in the three watersheds: 17,698 acres in the Albion River (64 percent of the total watershed) in the last 20 years; 4,562 acres in Cottaneva Creek (43 percent of the total watershed) in the last 15 years; and 6,899 acres in Pudding Creek (61 percent of the total watershed) in the last 20 years (NMFS 2013).

Recreational Areas and Activities

As a result of extensive private land ownership which is primarily zoned by the County for timber production, there is little if any recreation ongoing in the Diversity Stratum, and this threat is rated as Very Good and is considered a negligible or minor contribution to the conditions. However, the impact of activities associated with unauthorized OHV use, particularly during the winter months, is rated as Fair and considered to have a moderate contribution to the condition of Sediment: Gravel Quality and Distribution of Spawning Gravels**.** Unauthorized OHV use is typically most prevalent in areas adjacent to urban areas, and of the three watersheds, Pudding Creek is the most impacted (J. Ambrose, NMFS, personal communication, 2013).

Roads and Railroads

Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in the three watersheds. Road densities are high throughout the watersheds (3.3 miles/mile^2 in Cottaneva; 3.1 miles/mile^2 in Pudding; and 7.7 miles/mile^2 in Albion) and many of these roads were poorly situated and constructed[1], improperly maintained, and many have been abandoned rather than properly decommissioned. It is hoped, with the implementation of the MRC HCP, sediment input originating from the road networks in Cottaneva Creek and the

[1] The majority of these roads were constructed prior to the passing of the California Forest Practice Rules in 1973. Some roads are located in very erosive areas, particularly in Cottaneva Creek which has an erodibility rating of 8 (on a scale of 0-10) (NMFS 2013).

Albion River will decrease over time. The MRC HCP includes extensive road reconstruction, maintenance, and decommissioning actions which, over the 80-year lifespan of the HCP, should result in notable improvements to instream conditions.

Severe Weather Patterns

This threat is rated as Good or Fair for ten conditions. Because of the potential for severe weather to affect flows, it is rated as Poor and considered a major threat to Hydrology: Baseflow and Passage Flows. The impacts of a severe drought (in conjunction with ongoing diversions in the Albion River of surface flows) could adversely affect the summer rearing lifestage of steelhead in the watershed, particularly during the summer months.

Water Diversion and Impoundments

There are relatively few diversions or impoundments in the three watersheds, and this threat is rated as Very Good for nine conditions, Fair for two conditions, and Poor for Viability: Density, Abundance and Spatial Structure. This is due primarily to concerns over the impact of summer water diversions in portions of the upper Albion. Water diversions are a major concern in Marsh Creek (near Comptche) which was listed as a fully appropriated stream by the State Water Resources Control Board in 1998 (NMFS 2013).

Fishing and Collecting

Fishing is rated as Fair and considered a moderate contributor to the condition of Viability: Density, Abundance, and Spatial Structure primarily due to the ambiguity of the California Freshwater Sport Fishing Regulations. The regulations imply hatchery trout and hatchery steelhead are present in Cottaneva Creek and Albion River when in reality, they are not. Concerns were raised over potential fishing impacts from uninformed fishers who presume hatchery fish may be present in areas where they do not occur. Furthermore, the regulations authorize summer fishing with a bag limit of zero. Fish that are caught during a summer fishery are almost certainly exclusively listed steelhead and/or coho salmon juveniles which could be injured by being caught and landed and then released.

Limiting Conditions, Lifestages, and Habitats

The egg, summer rearing and winter rearing lifestages are most limited by current conditions and future threats facing steelhead in Cottaneva Creek, Pudding Creek, and the Albion River. The conditions most limiting include: Large Wood and Shelter; and Gravel Quality and Distribution of Spawning Gravels. The greatest threats to recovery in these watersheds result from Logging, Severe Weather, Fire and Roads.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating conditions and threats rated as Poor or Fair, as discussed above, although strategies that address other factors may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in these watersheds are discussed below with more detailed and site-specific recovery actions provided in "North-Central Coastal Diversity Stratum" Rapid Assessment.

Habitat Complexity: Large Wood and Shelter

Many reaches in the watersheds would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. Fencing and planting in the floodplains could result in major improvement to the lower reaches of the lower Albion River. Continuation of LWD enhancement efforts by the major landowners in these watersheds will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones. In addition to directly contributing to habitat complexity, LWD and other habitat features such as boulders support development of complex pools, and improve pool/riffle ratios.

Address Upslope Sediment Sources to Improve Gravel Quality and Quantity

Active and abandoned logging roads and skid trails are located throughout the three watersheds and likely contribute large volumes of sediment into the stream environment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Ongoing road work should include a component that closes and decommissions unnecessary and abandoned roads and skid trails to effectuate lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

High priority sites identified as major sources of sediment contribution should be the initial focus of future restoration actions. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Literature Cited

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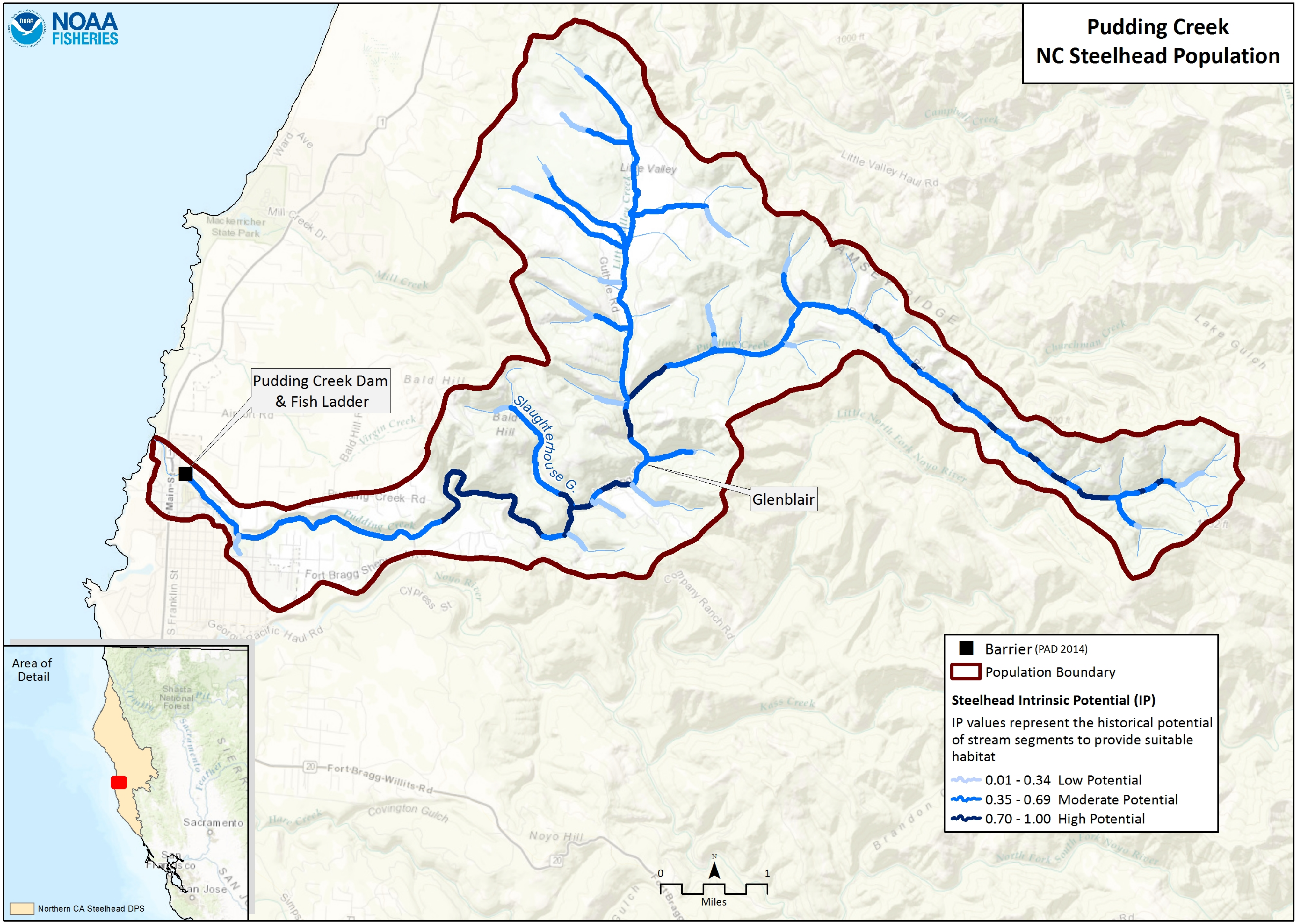
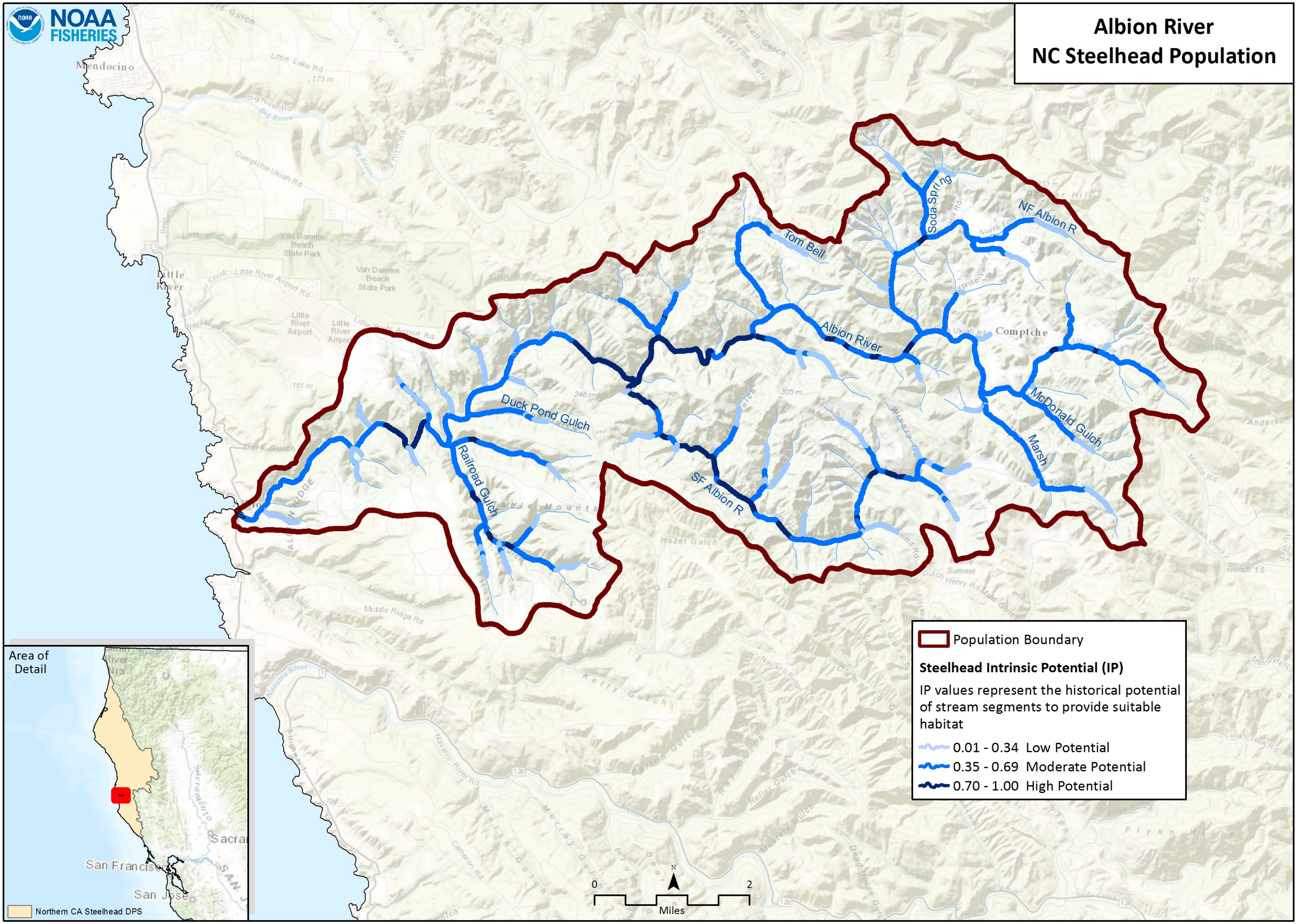
NOAA FISHERIES
Cottaneva Creek
NC Steelhead Population
Dunn
NF Cottaneva
MF Cottaneva
Cottaneva
Rockport
Cottaneva Ridge
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles



NOAA FISHERIES
Pudding Creek
NC Steelhead Population
Pudding Creek Dam
& Fish Ladder
Glenblair
Slaughterhouse G.
Little Valley
Bald Hill
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
Sacramento
Miles
0
1


Albion River
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
Albion River
NF Albion R
SF Albion R
Soda Spring
Tom Bell
Duck Pond Gulch
Railroad Gulch
McDonald Gulch
Marsh
Comptche
Mendocino
0
2
Miles

NC Steelhead DPS: North-Central Coastal Diversity Stratum (Pudding/Albion/Cottaneva)

Habitat & Population Condition Scores By Life Stage:
VG = Very Good
G = Good
F = Fair
P = Poor

Stresses: Key Attribute: Indicators	Steelhead Life History Stages: Adults	Eggs	Summer-Rearing Juveniles	Winter-Rearing Juveniles	Smolts
Riparian Vegetation: Composition, Cover & Tree Diameter			G	G	
Estuary: Quality & Extent	G		F	G	G
Velocity Refuge: Floodplain Connectivity	G			G	G
Hydrology: Redd Scour		G			
Hydrology: Baseflow & Passage Flows	G	G	F		G
Passage/Migration: Mouth or Confluence & Physical Barriers	G		G	G	G
Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios	G		F	F	
Habitat Complexity: Large Wood & Shelter	F		P	P	F
Sediment: Gravel Quality & Distribution of Spawning Gravels	F	P	F	F	
Viability: Density, Abundance & Spatial Structure	F		F		F
Water Quality: Temperature			F		G
Water Quality: Turbidity & Toxicity	F		G	F	F

NC Steelhead DPS: North-Central Coastal Diversity Stratum (Pudding/Albion/Cottaneva)													
Threat Scores **L: Low** **M: Medium** **H: High**		**Stresses**											
		Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Threats - Sources of Stress	**Agriculture**	L	L	L	L		L	L	L	L		L	L
	Channel Modification	L	L	L	L	L	L	L	L	L		L	L
	Disease, Predation, and Competition	L	L	L			L	L	M		M	L	L
	Fire, Fuel Management, and Fire Suppression	L	L	L	L		L	M	H	H		M	M
	Livestock Farming and Ranching	L	L	L	L		L	L	L	L		L	L
	Logging and Wood Harvesting	L	L	L	L		L	M	H	H		M	M
	Mining	L	L	L	L		L	L	L	L		L	L
	Recreational Areas and Activities	L	L	L	L		L	L	L	M		L	L
	Residential and Commercial Development	L	L	L	L		L	L	M	M		L	L
	Roads and Railroads	L	M	L	L		L	M	M	H		L	H
	Severe Weather Patterns	L	M	L	L	H	L	L	M	M		M	M
	Water Diversions and Impoundments	L	L	L	L	M	L	L	L	M	H	L	L
	Fishing and Collecting										M		
	Hatcheries and Aquaculture										L	L	L

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
CotC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical complex habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	20	CA Coastal Commission, CDFW, Mendocino Redwood Company, RWQCB	The historical potential of the Cottaneva Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Due to various constraints, the overall habitat potential is likely relatively small.
CotC-NCSW-1.1.1.2	Action Step	Estuary	Restore estuary function by reducing fine sediment input from the upper watershed.	3	100	CalFire, CalTrans, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
CotC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.	2	20	CalFire, CalTrans, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	10	CalFire, California Coastal Conservancy, CDFW, Mendocino Redwood Company	
CotC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	3	5	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelter				
CotC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches.	2	25	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	25	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	20	CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.5	Action Step	Habitat Complexity	Manage native trees in riparian areas for older age classes, and increased basal area.	3	100	CDFW, County of Mendocino, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.6	Action Step	Habitat Complexity	Work with stakeholders to develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	Mendocino Redwood Company, CalFire, NMFS, CDFW	Initial focus should be directed at lower floodplain areas. This strategy would provide benefits to steelhead as well as coho salmon. Due to presence of some infrastructure in the area, the plan should carefully evaluate potential impacts of wood mobilization during high flow events.
CotC-NCSW-6.1.1.7	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	20	Mendocino Redwood Company	NMFS programmatic biological opinion with the Corps and NOAA RC should be used to minimize permitting delays.
CotC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
CotC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	25	Mendocino Redwood, Private Landowners, CDFW, NMFS, CalFire	
CotC-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	100	Mendocino Redwood, Private Landowners	Most of the watershed is in timber management so a large portion of this cost will be absorbed into ongoing operations. However, this practice would have major benefits if implemented in the lower floodplain where numerous small landowners live. Riparian vegetation in these areas have been heavily impacted and it is likely costs will be proportionately greater than in the upper portions of the watershed.
CotC-NCSW-7.1.1.3	Action Step	Riparian	Plant native vegetation in Cottoneva Creek to promote streamside shade.	2	20	Mendocino Redwood, Private Landowners, CDFW, NMFS, CalFire	
CotC-NCSW-7.1.1.4	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	3	100	Mendocino Redwood Company	
CotC-NCSW-7.1.1.5	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	Mendocino Redwood Company	
CotC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
CotC-NCSW-8.1.1.1	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, NMFS, NRCS, RWQCB, USACE, USFWS	
CotC-NCSW-8.1.1.2	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	30	CalFire, CDFW, County of Mendocino, Mendocino Redwood Company, NRCS, RWQCB	
CotC-NCSW-11.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**				
CotC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
CotC-NCSW-11.1.1.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	2	25	CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-11.1.1.2	Action Step	Viability	Use standardized watershed assessments (Coastal Monitoring Plan) within sub-watersheds not previously evaluated in MRC's 2005 effort.	2	10	CalFire, CalTrans, CDFW, Mendocino Redwood Company, NMFS, Private Landowners	
CotC-NCSW-11.1.1.3	Action Step	Viability	Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.	3	20	CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
CotC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction and prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, Mendocino Redwood Company	This recommendation should be considered a standard practice. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities.
CotC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Mendocino Redwood Company	
CotC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CotC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams.	2	100	CalFire, Mendocino Redwood Company	
CotC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CotC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
CotC-NCSW-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should coordinate with resource agencies to minimize impacts to listed salmonids.	3	100	CalFire, CDFW, NMFS, NRCS	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions.
CotC-NCSW-15.2.1.3	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	20	CalFire, CDFW, County of Mendocino	
CotC-NCSW-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology				
CotC-NCSW-15.2.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire	
CotC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
CotC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Improve CDFW fishing regulations to minimize impacts to adult and juvenile steelhead.	2	2	CDFW	Fishing regulation include a summer fishery without a bag limit which could likely harm listed steelhead juveniles. References to hatchery trout (which are not planted in the watershed) should be removed from regulations so as to not inadvertently encourage fishing for a resource which is not present in the watershed.
CotC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CotC-NCSW-19.1.1.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Road surface treatment options will vary widely on road use, availability of local rock sources and geology.
CotC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-19.1.2.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
CotC-NCSW-19.1.2.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RPFs	
CotC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire, Mendocino Redwood Company	
CotC-NCSW-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
CotC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
CotC-NCSW-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
CotC-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.5.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
CotC-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
CotC-NCSW-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.6.2	Action Step	Logging	Minimize new road construction in riparian zones	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to CFPRs Class 1 streams with high IP value habitat.
CotC-NCSW-19.1.6.3	Action Step	Logging	See Roads and Railroads for additional recommendations.				
CotC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
CotC-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, CDFW, Private Landowners, RWQCB	

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
CotC-NCSW-19.2.1.3	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners, RWQCB	
CotC-NCSW-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
CotC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	Mendocino Redwood Company	
CotC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	3	10	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
CotC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	50	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Use best available management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 2015).	2	10	Mendocino Redwood Company	
CotC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Limit winter use of unsurfaced (unrocked) roads and recreational trails to decrease fine sediment loads.	2	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.9	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	5	Mendocino Redwood Company	
CotC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
CotC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	30	CalFire, CalTrans, Mendocino County, Mendocino Redwood Company, RWQCB, USACE	
CotC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in current and historical habitats.	3	10	CalFire, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, Mendocino Redwood Company, Private Landowners, RWQCB	
CotC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Geological Survey, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	
CotC-NCSW-23.2.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to hydrology (impaired water flow)				
CotC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead.	2	10	CalFire, CalTrans, CDFW, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RPFs, RWQCB, SWRCB	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
CotC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	1	20	CDFW, Private Landowners, SWRCB	
CotC-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonid recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of steelhead (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners	
CotC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, California Geological Survey, CalTrans, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners, RPFs, RWQCB	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat				
PudC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate Pudding Creek impoundment and its contribution/effect to salmonid survival (CDFG 2004).	1	5	CDFW, Lyme Timber, NMFS	The impoundment at Pudding Creek may function as winter habitat for steelhead and possibly as summer rearing habitat at the upper end of the impoundment. Water quality near the dam is often very poor during the summer/fall low flow period. Evaluation should include a component to assess native and exotic predators and determine if levels of predation are detrimental to viability targets. Evaluation should include potential benefits/detriments to tidewater goby, salmonids, and sculpin movement. Evaluation should include potential impacts to emigrating juvenile attempting to move upstream in the estuarine reach, description of the significance of various impacts, and whether the estuary promotes conditions suitable to delayed migration (and possible missing year class benefits).
PudC-NCSW-1.1.1.2	Action Step	Estuary	Provide passage under Highway 1 to the impoundment at Ocean Lake Mobile Home Park.	3	5	CalTrans, CDFW, Mendocino County	
PudC-NCSW-1.1.2	Recovery Action	Estuary	Increase and enhance habitat complexity features				
PudC-NCSW-1.1.2.1	Action Step	Estuary	Evaluate feasibility and benefits of repairing the dam at Highway 1 as appropriate to maintain over wintering habitat in the estuary (CDFG 2004).	3	10	CA Coastal Commission, Georgia-Pacific, USACE	
PudC-NCSW-1.1.2.2	Action Step	Estuary	Repair of the dam should based on the results of the evaluation study and only if benefits are found to outweigh the detriments to the Pudding Creek coho salmon and steelhead population. If evaluation study concludes the dam does not facilitate improved rearing conditions compared to an unimpaired estuary for coho salmon and steelhead, the dam should be removed, and the estuary restored to historical conditions.	3	10	CA Coastal Commission, USACE, CDFW, NMFS	
PudC-NCSW-1.1.3	Recovery Action	Estuary	Reduce toxicity and pollutants				
PudC-NCSW-1.1.3.1	Action Step	Estuary	Minimize potential impacts of water drafting from the Pudding Creek impoundment.	3	100	CDFW, City of Fort Bragg, Georgia-Pacific, SWRCB	The water right holder should evaluate the potential impacts of their water diversion to rearing juvenile salmonids. This will only likely need to occur if future diversions are markedly increased over current diversions.
PudC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
PudC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Lyme Timber, NOAA RC, Private Landowners	
PudC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	20	CalFire, Lyme Timber	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Evaluate channel restoration opportunities in the Little Valley subwatershed and evaluate potential benefits to juvenile rearing habitats.	2	7	CDFW, Lyme Timber, NOAA RC, RWQCB, Trout Unlimited	The evaluation should consider all available historical documentation and include input from geomorphologists and restoration experts. The evaluation should include a series of recommendation to restore channel complexity in Little Valley if restoration is determined to have a net benefit to juvenile rearing condition and quantity. Water extraction from Little Valley should also be evaluated and compliance with State Water Law determined. Campbell Timberland Management (now Lyme Timber) has initiated some beneficial "passive" restoration efforts in Little Valley a number of years ago. These efforts have consisted of removing all cattle and ceasing agricultural activities in the floodplain and terrace. The grassland meadows are no longer mowed in an effort to allow riparian vegetation to recolonize the riparian terrace and valley. According to Campbell's analysis of historical aerial photography, the entire Little Valley Creek stream channel was ditched and straightened in the 1950s/1960s. Most sinuous reaches were bypassed but can still be observed in present aerial photos.
PudC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
PudC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Implement a large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).	2	5	CDFW, Lyme Timber, Trout Unlimited	It is anticipated that significant cost savings (and ecological benefits) would be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used over engineered structures. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the watershed was allowed to stay in place. These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity and shelter values in potential rearing and migration reaches. Some large woody debris supplementation has already occurred in the watershed.
PudC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CDFW, Lyme Timber, RWQCB, USACE	Evaluate road relocation as an option prior to initiating stream bank stabilization in Pudding Creek watershed. This recommendation should be standard practice for current or future stream bank protection projects.
PudC-NCSW-6.1.1.3	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	3	100	CDFW, Lyme Timber, NMFS	
PudC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve shelter and percent primary pools				
PudC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	20	CDFW, Lyme Timber, Private Landowners	
PudC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Protect existing riparian areas to maintain LWD supply and canopy.	3	20	CDFW, Lyme Timber, NMFS, Private Landowners	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	100	CDFW, Lyme Timber, NMFS, Private Landowners	
PudC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-7.1.1	Recovery Action	Riparian	Improve tree diameter				
PudC-NCSW-7.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Lyme Timber,	Historical logging practices effectively removed all of the original conifer overstory (principally redwood) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas.
PudC-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CDFW, Lyme Timber	Most of the riparian areas along mainstem Pudding Creek are under forest management and do not require replanting. However, if restoration of the Little Valley is anticipated, efforts should be directed at replanting the areas along riparian corridors in Little Valley. Little Valley was cleared for agricultural purposes and cattle grazing. Currently, cattle grazing is a minor land use in the area.
PudC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
PudC-NCSW-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Lyme Timber, Private Landowners, RWQCB	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels.
PudC-NCSW-8.1.1.2	Action Step	Sediment	Decommission Slaughterhouse Gulch riparian road.	3	10	CalFire, California Geological Survey, Lyme Timber, RWQCB	Slaughterhouse Gulch was identified as IP-km (lower value) and it is currently a subwatershed where spawning occurs. However, juvenile rearing is unlikely in all but the wettest water years.
PudC-NCSW-8.1.1.3	Action Step	Sediment	Evaluate all roads and skid trails throughout the winter period on private and public lands.	2	100	CDFW, NMFS, Private Landowners, RWQCB	
PudC-NCSW-8.1.1.4	Action Step	Sediment	Permitting agencies should evaluate all authorized erosion control measures during the winter period.	2	60	CalFire, CDFW, RWQCB	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-11.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**				
PudC-NCSW-11.1.1	Recovery Action	Viability	Increase spawner density				
PudC-NCSW-11.1.1.1	Action Step	Viability	Continue ongoing life cycle monitoring station at Pudding Creek dam (CDFG 2004). Establish consistent reporting methods to ensure ESU-wide consistency.	1	10	CDFW, Lyme Timber, NMFS, Trout Unlimited	
PudC-NCSW-11.1.1.2	Action Step	Viability	Re-evaluate spawner density targets pending completion of Little Valley habitat suitability report.	3	10	NMFS	
PudC-NCSW-11.1.1.3	Action Step	Viability	Continue juvenile monitoring originally initiated by CDFW in 1980's near the Slaughterhouse Gulch confluence.	2	10	CDFW, Lyme Timber	
PudC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
PudC-NCSW-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Lyme Timber	Timber harvest remains a threat to salmonid habitat in Pudding Creek watershed, but at diminished levels compared to historical practices. Even with application of new California Forest Practice Rules this threat is anticipated to continue.
PudC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
PudC-NCSW-19.1.2.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Lyme Timber	
PudC-NCSW-19.1.2.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Lyme Timber	
PudC-NCSW-19.1.2.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, Lyme Timber	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identify areas for prioritization.
PudC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
PudC-NCSW-19.1.3.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Lyme Timber	
PudC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
PudC-NCSW-19.1.4.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Lyme Timber	
PudC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
PudC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
PudC-NCSW-19.2.1.1	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	CalFire, Lyme Timber	Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
PudC-NCSW-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CDFW, Mendocino County, RWQCB, SWRCB	
PudC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 2015).	2	100	CalFire, Lyme Timber, Private Landowners	Legacy roads from past logging activity continue to impact Pudding Creek watershed.
PudC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Lyme Timber	Many roads in the watershed have inside ditches.
PudC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Lyme Timber, Private Landowners	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct an assessment of number and extent of dissipaters to determine cost for upgrade.
PudC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Lyme Timber, Private Landowners	Sediment traps will require a significant maintenance commitment.
PudC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
PudC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	3	100	CalFire, Lyme Timber, Private Landowners	
PudC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
PudC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
PudC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Lyme Timber, Private Landowners	This action is part of ongoing road maintenance and should be directed at the entire road network.
PudC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Lyme Timber, County, Mendocino Redwood Company, Private Landowners	Due to proximity of Fort Bragg to Pudding Creek, unauthorized trail use by off road vehicles is a common occurrence. Implement measures to ensure Sherwood Ridge Road remains closed during the winter period. The Noyo Watershed Alliance has worked to maintain winter closures. Ongoing management practices in the watershed include maintenance of existing gate and other forms of road closure.
PudC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
PudC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies.	3	10	CDFW, Mendocino County, RWQCB, SWRCB	
PudC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CalFire, CDFW, Lyme Timber, RWQCB, SWRCB	Few if any water diversions are present along mainstem Pudding Creek aside from the diversion lower in the watershed at the Pudding Creek dam.
PudC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration				
PudC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Ensure Pudding Creek fish ladder is performing sufficiently to pass migrating fish during drought conditions.	2	20	CDFW, Lyme Timber, Georgia-Pacific	
PudC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment and/or toxicity)				

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Work with stakeholders to ensure patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalFire, Lyme Timber	
PudC-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, Lyme Timber	Conduct an assessment of high-risk shallow-seeded landslide areas to determine extent and protective measures.

Albion River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
AlbnR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
AlbnR-NCSW-1.1.1.1	Action Step	Estuary	Remove riprap and gabion rock within the estuary and restore with a bioengineering solution.	2	5	California Coastal Conservancy, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-1.1.1.2	Action Step	Estuary	Identify key locations to install LWD structures and improve shelter within the estuary.	2	10	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	
AlbnR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
AlbnR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	
AlbnR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	
AlbnR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
AlbnR-NCSW-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the Comptche area to minimize effects to the North Fork Albion and mainstem Albion.	2	5	NOAA RC, NRCS, Private Landowners, SWRCB	
AlbnR-NCSW-3.1.1.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	30	CDFW, NOAA RC, Private Landowners, SWRCB	
AlbnR-NCSW-3.1.1.3	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	100	CDFW Law Enforcement, NMFS OLE, SWRCB	
AlbnR-NCSW-3.1.1.4	Action Step	Hydrology	Install streamflow gaging devices to determine the level of impairment to natural flow. Determine sites appropriate for gaging below Comptche on the mainstem and the North Fork.	3	10	CDFW, Mendocino Redwood Company, NMFS, Private Landowners, USGS	
AlbnR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
AlbnR-NCSW-5.1.1.1	Action Step	Passage	Investigate the feasibility of removing the earthen dam on Marsh Creek to increase habitat availability for salmonids.	3	2	CDFW, NOAA RC, Private Landowners	
AlbnR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				
AlbnR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	2	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Utilize information developed on LWD demand and recruitment potential in the MRC Albion Watershed Analysis to target areas lacking LWD for remediation.	2	2	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking. Consider falling existing riparian trees as a method to increase complexity and LWD frequencies.	3	50	CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	
AlbnR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic diversity)				

Albion River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
AlbnR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Increase the frequency of LWD to rate as Good (over 75% of IP-km within the watershed).	2	20	CDFW, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners	
AlbnR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-7.1.1	Recovery Action	Riparian	Improve tree diameter				
AlbnR-NCSW-7.1.1.1	Action Step	Riparian	Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for salmonids (CDFG 2004). Focus efforts on the Albion River and tributaries in the eastern part of the watershed.	2	20	CDFW, Private Landowners	
AlbnR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
AlbnR-NCSW-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings that are identified in the MRC Albion River Watershed Analysis or other credible assessments.	2	10	CDFW, Mendocino County, NOAA RC, Private Landowners	
AlbnR-NCSW-8.1.1.2	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW, or CalFire.	2	20	CDFW, NOAA RC, NRCS, RWQCB	
AlbnR-NCSW-11.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**				
AlbnR-NCSW-11.1.1	Recovery Action	Viability	Increase spatial structure and diversity				
AlbnR-NCSW-11.1.1.1	Action Step	Viability	Monitor the response of population abundance and key habitat attributes to recovery efforts across the watershed.	3	24	CDFW, Mendocino Redwood Company, NMFS, Private Landowners	
AlbnR-NCSW-11.1.1.2	Action Step	Viability	Conduct surveys in areas of the mainstem Albion, South Fork Albion, and the North Fork Albion, and selected tributaries.	2	20	CDFW, Mendocino Redwood Company, NMFS	
AlbnR-NCSW-11.1.1.3	Action Step	Viability	Support a community based salmonid monitoring program in the Albion watershed.	3	10	CDFW, NOAA RC, Private Landowners, Public	
AlbnR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**				
AlbnR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
AlbnR-NCSW-19.1.1.1	Action Step	Logging	Work with logging companies and private landowners to reduce the percent acres of the watershed harvested to less than 25 percent in a ten year period.	3	20	CalFire, CDFW, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB	
AlbnR-NCSW-19.1.1.2	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	60	CalFire, CDFW, Mendocino County, NMFS, Private Landowners	
AlbnR-NCSW-19.1.1.3	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	60	CalFire, Mendocino County, Mendocino Redwood Company, NMFS	
AlbnR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
AlbnR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and implement road upgrades on Docker Hill Road along the North Fork Albion River.	2	10	Lyme Redwood Company, CDFW, Mendocino County, Mendocino Redwood Company, NOAA RC, Private Landowners	
AlbnR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Conduct road and sediment assessment on the Comptche Ukiah Road segment that drains to the Albion Watershed.	2	5	Mendocino County Department of Public Works, NOAA RC	
AlbnR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	
AlbnR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
AlbnR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Albion River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
AlbnR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
AlbnR-NCSW-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	5	CDFW, NRCS, Private Landowners, RCD	
AlbnR-NCSW-23.2.1.3	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 2015).	2	20	Mendocino County, NOAA RC, NRCS, Private Landowners, RCD	
AlbnR-NCSW-23.2.1.4	Action Step	Roads/Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources at high priority areas.	2	15	CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
AlbnR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
AlbnR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
AlbnR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users in the Comptche area to minimize depletion of summer base flows during droughts. Provide restoration funding for alternatives such as storage tanks and rainwater harvest to rural residential residents.	2	10	Mendocino County, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	2	20	CDFW, Private Landowners, SWRCB	
AlbnR-NCSW-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to watershed hydrology				
AlbnR-NCSW-25.1.1.1	Action Step	Water Diversion/Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead.	3	10	CDFW	
AlbnR-NCSW-25.1.1.2	Action Step	Water Diversion/Impoundment	Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow	3	20	CDFW	
AlbnR-NCSW-25.1.1.3	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	2	10	CDFW, SWRCB	
AlbnR-NCSW-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
AlbnR-NCSW-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
AlbnR-NCSW-25.2.1.1	Action Step	Water Diversion/Impoundment	Evaluate and monitor the Lake and Streambed Alteration Agreement program compliance related to all water diversions (CDFG 2004).	2	5	CDFW, NMFS	
AlbnR-NCSW-25.2.1.2	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	10	CDFW, County of Mendocino, NMFS, NMFS OLE, SWRCB	
AlbnR-NCSW-25.2.1.3	Action Step	Water Diversion/Impoundment	Support the SWRCB in regulating groundwater.	3	100	CDFW, Mendocino County, NMFS, SWRCB	
AlbnR-NCSW-25.2.1.4	Action Step	Water Diversion/Impoundment	Promote conjunctive use of water with water projects whenever possible.	2	10	CDFW, County of Mendocino, NMFS, RCD, SWRCB	

Central Coastal Diversity Stratum

This stratum includes populations of steelhead that spawn in watersheds between the Navarro River and Gualala River, inclusive. These watersheds exhibit a narrower band of coastal influence than those to the north, and tend to be warmer and drier, particularly in the interior.

The populations that have been selected for recovery scenarios are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum, followed by the Rapid Assessment of the Supporting populations:

- Garcia River
- Gualala River
- Navarro River
- Central Coastal Diversity Stratum Rapid Assessment
    - Brush Creek
    - Elk Creek
    - Schooner Gulch

NC steelhead Central Coastal Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting.

Diversity Stratum	NC winter-run steelhead populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Central Coastal	Brush Creek	I	Supporting	21.4	6-12	126-255
	Elk Creek	I	Supporting	34.5	6-12	205-412
	Garcia River	I	Essential	135.4	23.4	3,200
	Gualala River	I	Essential	396.7	20.0	7,900
	Navarro River	I	Essential	387.6	20.0	7,800
	Schooner Gulch	D	Supporting	7.7	6-12	44-90
	Central Coastal Diversity Stratum Recovery Target					**18,900**

NC steelhead Central Coastal Diversity Stratum

Garcia River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Central Coastal
- Spawner Abundance Target: 3,200 adults
- Current Intrinsic Potential: 135.4 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Quantitative abundance and distribution estimates of winter-run steelhead within the Garcia River watershed are sparse or non-existent, although recent direct observations indicate they are well distributed and self-sustaining throughout the watershed (TCF 2006). It is currently unknown if this steelhead population is moving towards recovery or is in slow decline. Anecdotal accounts of steelhead from the early 1920s suggest abundant and sustainable runs within the Garcia River, with adult steelhead typically arriving in late November and spawning through April (Warmerdam 2010).

Although degraded from pristine conditions, a substantial amount of high value habitat still exists within the Garcia watershed. The highest value habitat currently available for steelhead occurs within the upper sub-watershed areas where suitable water temperatures persist throughout the summer months.

History of Land Use

The early period of logging and timber harvest in the Garcia River watershed began in the late 1860s and ended in 1915. In the 1950s, logging resumed in response to the post-World War II housing boom, with intense harvest rate and loggers utilizing more advanced technologies and heavy machinery. This period of intense logging ended in 1961 and left the watershed in a much degraded state. Large amounts of land were again harvested for timber more recently as 52-percent of the basin was harvested between 1987 and 1997 (NCRWQB 2005). Logging and wood harvest still occur within the watershed; however, timber harvest practices have improved as compared to previous logging areas, and, therefore, logging-related impacts to salmonid habitat may be less likely. Logging the forest in the watershed triggered increased sediment production, and floodplain development in the lower watershed disconnected the river from deposition zones. The consequence of these two land uses was deposition in the estuary, diminishing the habitat in that important area.

Current Resources and Land Management

A large tract (24,000 acres) of the Garcia River was purchased in 2004 by the Conservation Fund, a group that has been in partnership with The Nature Conservancy, State Coastal Conservancy, Wildlife Conservation Board, and the California Department of Fish and Wildlife in developing and implementing an Integrated Resource Management Plan (2006) for the basin. The Conservation Fund is implementing sustainable management practices that include decreasing the intensity of timber harvests, decreasing timber harvest frequency, improving roads, and widening riparian buffers to improve water quality instreams degraded by past land uses. Other land uses occurring within the Garcia watershed include: agriculture, other timber companies, dairies, and cattle grazing and ranching. Conversion of hillside forest stands to vineyards is also occurring. The majority of the watershed is privately owned. Many government, public interest, and tribal groups and agencies are active or have jurisdiction within the watershed as well. The following pertinent documents are available for the Garcia River watershed:

- Garcia River Forest: Integrated Resource Management Plan (TCF 2006);
- Evaluation of the Garcia River Restoration with Recommendations for Future Projects (Bell 2003);
- Action Plan for the Garcia River Watershed Sediment TMDL (NCRWQB 2001);
- Garcia River Sediment Total Maximum Daily Load (USEPA 1998);
- Garcia River Estuary Cross Sections (Jackson 1998; Jackson 1999);
- A Salmon Spawning Survey for Portions of Ten Mile River, Casper, and the Garcia River (Maahs 1996);
- Fisheries Elements of the Garcia River Estuary Enhancement Feasibility Study (Higgins 1995);
- Garcia River Drilling Mud Spill: Damage Assessment and Suggestions for Mitigation, Restoration, and Monitoring (Higgins 1992); and
- The Garcia River Watershed Enhancement Plan (Monschke and Caldon 1992).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for steelhead: LWD frequency, shelter rating, and streamside road density. Other indicators that are identified as impaired to the extent that rehabilitation work is needed include the following: physical barriers, estuary quality and extent, and water temperature. Recovery strategies will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Garcia River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Estuary: Quality and Extent

The river forms an estuary downstream of Hathaway Creek and maintains an open-sandbar during the dry season. Information provided by local residents suggests that the Garcia River estuary has aggraded over the years due to increased sediment loads as a result of past logging practices. Other investigations indicate that the estuary may be recovering and is getting deeper (Jackson 1998; Jackson 1999). It is still unclear to what extent the estuary is changing and at what rate. Other impacts that influence the quality and extent of the Garcia River estuary include current livestock activities around historic tidal sloughs, and potential reductions to freshwater inflow. The magnitude and duration of freshwater inflow is an essential component of a healthy estuary ecosystem and can dictate the quality and extent of rearing conditions for summer and smolt juvenile steelhead.

Floodplain Connectivity: Velocity Refuge

The historic floodplains in the lower Garcia River watershed have been disconnected due to a century of channel management including straightening, embankment, and willow revetment. Floodplains when inundated during winter and spring are the most productive habitats for salmonids because of the vast space and high food production, resulting in high growth rates and subsequently increased viability of the juvenile life stage.

Sediment Transport: Road Density

High road densities within the Garcia River watershed are primarily associated with past timber harvest. While road building standards have improved greatly in recent years, old road networks and landings still pose a high erosion risk (Monschke and Caldon 1992). Common problems with existing roads within the Garcia River include perched or raveling fills on the outside road edge; fill gullying at watercourse crossings; shot-gunned culverts, or short culverts; inadequate or missing downspouts; and plugged ditches (TCF 2006). A major challenge for the future will be identifying and remediating these problem roads (TCF 2006). High sediment yields from failing roads have greatly affected watershed sediment transport processes and gravel quality in the past, and if continued, will impair habitat conditions for salmonids.

Sediment: Gravel Quality and Distribution of Spawning Gravels

The Garcia River watershed is comprised of very unstable soil types and has a history of intensive logging and associated logging road networks (Monschke and Caldon 1992). The Garcia Watershed Enhancement Plan (Monschke and Caldon 1992) found that excessive fine sediment exists in the coarse spawning gravels within the lower river and tributaries. Other habitat inventories suggest that quality gravel exists within many watershed tributaries and can provide suitable spawning gravels for salmonids (CDFG 2002; 2003a; 2003b; 2004; 2005). Undoubtedly, suitable spawning gravel exists in some areas within the watershed and other areas still are impaired from past land use. Steelhead are much less restricted than Chinook salmon to the mainstem for spawning and are more likely to find better spawning habitat in higher basin reaches and tributaries. However, impaired gravel quality in the mainstem or other areas may reduce macro-invertebrate production that supports summer and seasonal rearing salmonids.

Passage/Migration: Mouth or Confluence and Physical Barriers

A high percentage of the historic steelhead habitat within the Garcia River watershed is currently accessible, although some fish passage impairments do exist within the watershed (CALFISH Passage Assessment Database 2015). Most identified passage impairments are partial barriers at stream crossings that may preclude steelhead reaching spawning destinations in the upper mainstem and adjacent tributaries under certain flow conditions. Some logjams from past logging have also been identified (Bell 2003). For steelhead, additional barriers exist in the South Fork Garcia and Hathaway Creek.

Habitat Complexity: Large Wood and Shelter and Altered Pool Complexity and/or Pool/Riffle Ratios

Extensive CDFW stream surveys (CDFG 2002; 2003a; 2003b; 2004; 2005) indicate that many streams lack pool shelter complexity and desirable riffle/pool ratios. These habitat complexity features have been impaired primarily due to a large wood deficit within the stream channel. Past logging and degraded riparian zones have severely limited the natural recruitment of large wood in many historically productive streams within the watershed. The Conservation Fund and their partners have embarked on many instream large wood placement projects that have improved habitat complexity in some areas (TCF 2006). However, many other stream reaches will require similar supplementation of LWD, boulders, and other channel forming features to encourage more desirable pool/riffle ratios (including primary pools) and increase mean shelter ratings. High priority steelhead streams in need of LWD placement include Blue Waterhole, North Fork, Inman Creek, Signal Creek, and Graphite Creek. Rehabilitating these streams will greatly improve the quality of available spawning and rearing habitat for steelhead.

Riparian Vegetation: Composition, Cover & Tree Diameter and Water Quality: Temperature
Portions of the Garcia River have been identified as having water temperatures unsuitable for summer rearing juvenile steelhead (see KRIS Garcia River[1]). Including some identified suitable streams for summer rearing; water temperatures have likely increased due to altered riparian structure, reduced canopy cover and lost old growth as a result of past logging practices. A shift to warmer water temperatures has limited the amount of preferable summer rearing habitat in some streams and has likely reduced juvenile steelhead growth and survival. Specific sub-basins of the Garcia River in need of riparian rehabilitation include: Blue Waterhole Creek, Inman Creek and the mainstem Garcia River. Promoting long-standing tree growth and implementing planting programs over time will increase shade, which will contribute to cooling ambient temperatures during the summer months in stream corridors.

Habitat Complexity: Large Wood and Shelter
The lower seven miles of the mainstem Garcia River flows through an alluvial valley where large amounts of sediment would naturally deposit. Following intensive timber harvest and poor land management, sediment deposition increased substantially during the previous several decades. Additionally, large wood recruitment was lost as riparian habitat was destroyed, limiting the amount of channel forming features (LWD) that encourage sediment sorting and scouring of large pools.

Threats
The following discussion focuses on those threats that were rated as High or Very High (See Garcia River CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in the Garcia River CAP Results.

Logging and Wood Harvesting
Logging and wood harvesting remains a threat to salmonid habitat quantity and quality within the Garcia River watershed. Timber harvest practices have improved greatly within the bounds of the Conservation Fund property and subsequent implementation of the Integrated Resource Management Plan (TCF 2006). However, other portions of the watershed still face accelerated timber harvest rates and high impact harvest techniques. Additionally, habitat degradation (gravel quality, water temperature, instream wood recruitment) associated with past timber harvest persists throughout the watershed, although some processes are currently in a state of recovery. Future management and recovery actions need to protect salmonid high value habitat

[1] http://krisweb.com/biblio/biblio_garcia.htm

from degraded water quality conditions (turbidity and increased temperature) associated with timber harvest, and ensure the continuation of watershed rehabilitation efforts.

Roads and Railroads

Even with current logging road improvements and standards (rolling dips, rock surfaces, and road widths), legacy logging roads remain a threat to salmonid habitat quantity and quality throughout the Garcia River watershed. Impaired passage and migration at road crossings will continue to limit access to suitable habitat, and fine sediment inputs from poorly built, improperly maintained, and abandoned roads will continue. More efficient road networks, removal and replacement of impassable and undersized culverts, and radical decommissioning efforts on problem roads will prevent further salmonid habitat degradation within the watershed.

Water Diversions and Impoundments

Currently, there are no large long standing dams within the Garcia River watershed. Watershed hydrology is relatively unimpaired and free from major water diversions when compared to most watersheds within the NCCC Recovery Domain. However, concerns regarding future land uses, increasing agriculture, and increasing illegal marijuana cultivation pressure could increase water demand and further reduce spring and summer streamflows. Additionally, future streamflow alterations could alter the hydrodynamics of the estuary during the summer months. Provisions need to be made that ensure future residential and agricultural development do not adversely impact summer and spring baseflows or groundwater recharge.

Livestock Farming and Ranching

Livestock farming and ranching have been reduced around the lower Garcia River/estuary, which has rehabilitated some stream riparian areas and significantly reduced erosion of adjoining properties. However, the historic quality and extent of the Garcia River estuary is still impaired, as some tidal sloughs continue to be disturbed by cattle activities.

Fishing and Collecting

Poaching within the Garcia River continues to be a major concern within the Garcia River for fisheries managers and restoration practitioners (Joshua Fuller, NMFS, personal communication, 2016). In March 2012, law enforcement from CDFW and the Mendocino County Sheriff's Department seized 18 (17 females, 1 male) wild steelhead from a local non-tribal resident. In response, Congressman Jared Huffman, state, federal, and tribal entities and conservation groups worked together in developing an agreement that made combating poaching a shared responsibility, and outlined a common strategy to protect critically low populations of steelhead, coho and Chinook salmon of the Garcia River. The Manchester-Point Arena Band of Pomo Indians developed *A Resolution of the Business Committee of the Manchester-Point Arena Band of Pomo*

Indians for the Protection of Garcia River Endangered Species (Resolution No. #327-11-07-2014). Implementation of this Resolution has made significant progress; however, reports of illegal poaching activities still occur during periods of low-flow. This threat to ESA-listed salmonids of the Garcia River will continue until all poaching has ceased.

Limiting Stresses, Lifestages, and Habitats

The threat and stress analysis within the CAP workbook suggests that juvenile productivity is likely limiting adult steelhead abundance within the Garcia River watershed. Inadequate stream shading, higher water temperatures, impaired gravel quality (spawning and benthic food productivity), and reduced habitat complexity have reduced the quality and extent of rearing habitat.

General Recovery Strategy

Improve Canopy Cover and Reduce Stream Water Temperature

Stream canopy cover conditions have improved within many tributaries of the Garcia River watershed, and will continue to improve in areas protected from future logging. However, in many areas of Blue Waterhole, Inman Creek, and the mainstem Garcia River, riparian rehabilitation efforts will need to be implemented to improve the extent and quality of summer rearing conditions in these potentially productive sub-basins.

Improve Habitat Complexity and LWD Recruitment

Pool shelter ratings and primary pool frequencies are limited in most tributaries in the Garcia River watershed. Strategically placing channel forming features in high priority reaches of the Blue Waterhole, North Fork, Inman Creek, Signal Creek, and Graphite Creek sub-basins will increase surface water hydrologic connectivity in highly aggraded reaches and increase summer rearing production. Additionally, establishing appropriate size riparian buffer zones throughout the watershed will increase stream shading and promote natural LWD recruitment.

Protect Natural Hydrologic Conditions

With physical habitat features improving and slowly recovering in many portions of the watershed, protecting spring and summer hydrologic conditions will be essential toward recovering all salmonids within the Garcia River watershed. Any alternatives to the natural watershed hydrology will present a future threat to the recovery of steelhead due to potential reductions in groundwater and consequently surface flows. Reducing suitable surface flows for summer rearing steelhead will not only limit the current extent of summer rearing within the basin, but may impair the quality of seasonal rearing conditions within the estuary.

Protect, Enhance, and Rehabilitate the Quality and Extent of the Garcia River Estuary
Efforts should be implemented to reclaim tidal sloughs from cattle grazing and agriculture within some areas of the Garcia River estuary. Integrating Hathaway Creek into future estuary rehabilitation efforts should be investigated.

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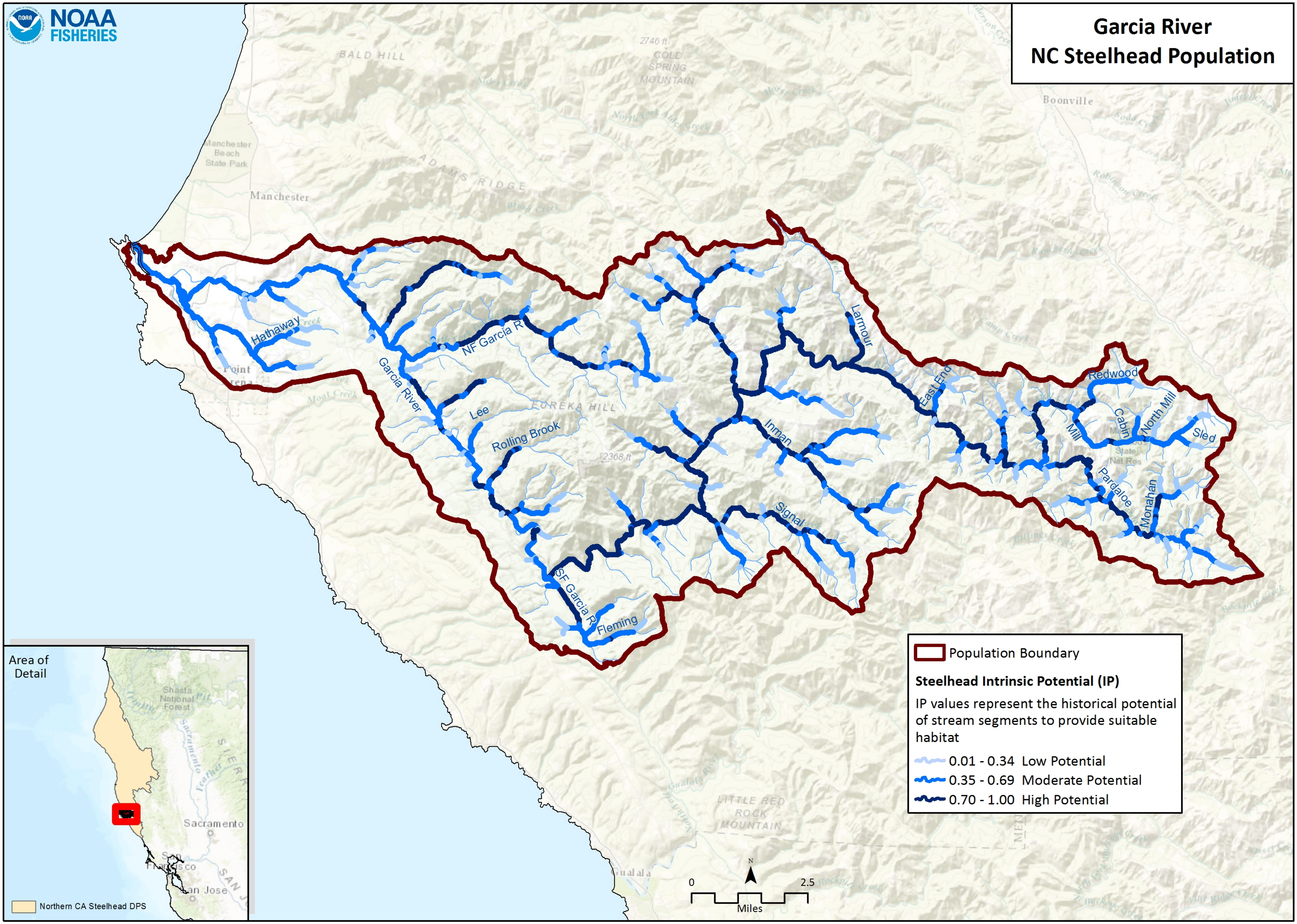
Garcia River
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
Sacramento
0
2.5
Miles
Hathaway
Garcia River
NF Garcia R
Lee
Rolling Brook
SF Garcia R
Fleming
Larmour
East End
Inman
Signal
Redwood
Mill
Cabin
North Mill
Sled
Pardaloe
Monahan
Manchester
Boonville
BALD HILL
ADAMS RIDGE
EUREKA HILL
LITTLE RED ROCK MOUNTAIN
Gualala

NC Steelhead Garcia River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>6 Key Pieces/100 meters)	Good
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	55% streams 79% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	18% streams/ 6% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 spawners per IP-Km	1-20 spawners per IPKm	20-40 Spawners per IP-Km (e.g., Low Risk Extinction Criteria)		1-20 spawners per IPKm	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	91% streams/ 98% IP-km (>50% stream average scores of 1 & 2)	Very Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>6 Key Pieces/100 meters)	Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	64% streams/ 83% IP-km (>40% average primary pool frequency)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	55% streams 79% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	18% streams/ 6% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.06 Diversions/10 IP km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	91% streams/ 56% IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	91% streams/ 98% IP-km (>50% stream average scores of 1 & 2)	Very Good
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>6 Key Pieces/100 meters)	Good

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	55% streams 79% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	18% streams/ 6% IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-Km	75% of IP-Km to 90% of IP-Km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	91% streams/ 98% IP-km (>50% stream average scores of 1 & 2)	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	18% streams/ 6% IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.06 Diversions/10 IP km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.147% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	1.134% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	15% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.2 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.8 Miles/Square Mile	Poor

NC Steelhead Garcia River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Medium	Medium
2	Channel Modification	Low	Low	Medium	Low	Medium	Medium	Medium
3	Disease, Predation and Competition	Low		Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	High		Medium		Medium		High
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Medium	Medium
8	Logging and Wood Harvesting	Medium	Low	High	High	Medium	High	High
9	Mining	Low	Low	Low	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Low	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Low	Low	Low	Low	Low
12	Roads and Railroads	Medium	Low	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Low	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Low	Low	High	Low	High	Low	High

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-1.1.1	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics				
GarcR-NCSW-1.1.1.1	Action Step	Estuary	Investigate and determine if the river/estuary mouth dynamics have changed from historical conditions (i.e. opening/closing patterns). Evaluate passage conditions relative to adult salmonid run timing.	2	10	BLM, CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB	
GarcR-NCSW-1.1.1.2	Action Step	Estuary	If determined necessary, develop and implement strategies that address adverse passage conditions for adult salmonids caused by altered river mouth dynamics.	3	20	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.2	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics				
GarcR-NCSW-1.1.2.1	Action Step	Estuary	Investigate the value of re-aligning the lower estuary channel from Minor Hole to the mouth in efforts to increase estuary depth and improve tidal wetlands.	2	10	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.2.2	Action Step	Estuary	If determined beneficial to estuary health and function, develop and implement a lower estuary channel re-alignment project.	2	10	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.3	Recovery Action	Estuary	Increase the physical extent of estuarine habitat				
GarcR-NCSW-1.1.3.1	Action Step	Estuary	Investigate the extent of sedimentation within the estuary associated watershed legacy impacts (e.g. logging). Evaluate sediment transport within the estuary and determine if the estuary is "filling" with sediment or "flushing" sediment (i.e., recovering).	2	10	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.3.2	Action Step	Estuary	Investigate and determine the current vs. historical extent of the Garcia estuary. Include tracts of salt and freshwater marshes, sloughs, tidal channels, etc.	2	10	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.3.3	Action Step	Estuary	Evaluate, design, and implement strategies to enhance habitat conditions within Hathaway Creek and near its confluence with the Garcia River main stem. Consider thinning vegetation within lower Hathaway to increase hydrologic circulation. Optimize winter rearing habitat/refuge while considering upstream migration to upper Hathaway Creek if determined beneficial.	2	10	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.3.4	Action Step	Estuary	Evaluate, design, and implement rehabilitation projects targeting tidal sloughs and off-channel habitats impaired by cattle located within the historical extent of the Garcia River estuary.	2	5	BLM, CDFW, NMFS, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.3.5	Action Step	Estuary	Continue estuary rehabilitation efforts (public acquisition and easements, Bell 2003).	2	10	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.4	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features				
GarcR-NCSW-1.1.4.1	Action Step	Estuary	Increase the percentage of area containing high value habitat complexity elements and features (SAV, LWD, boulders, marshes, vegetation, pools > 2 meters).	2	10	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.4.2	Action Step	Estuary	Identify key locations to install LWD structures targeting increased pool depth and habitat conditions within the Garcia estuary.	2	10	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC	
GarcR-NCSW-1.1.4.3	Action Step	Estuary	Continue working with landowners and rehabilitating riparian conditions within the Garcia estuary.	2	50	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.5	Recovery Action	Estuary	Improve estuarine freshwater inflow				
GarcR-NCSW-1.1.5.1	Action Step	Estuary	Install a stream gauge immediately upstream of the estuary to monitor inflow conditions during the dry season.	2	10	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, RCD, RWQCB, SWRCB, The Nature Conservancy	

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-1.1.5.2	Action Step	Estuary	Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions relative to juvenile salmonid estuarine summer rearing (osmo-regulating and non-osmoregulating).	2	10	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.5.3	Action Step	Estuary	Develop a stream flow model to identify and implement a minimum freshwater inflow threshold to ensure optimal estuary health and function for rearing salmonids.	2	10	CDFW, Friends of the Garcia River, NMFS, NRCS, RCD, RWQCB, SWRCB, The Nature Conservancy	
GarcR-NCSW-1.1.6	Recovery Action	Estuary	Improve estuarine water quality				
GarcR-NCSW-1.1.6.1	Action Step	Estuary	Install continuous water quality monitoring stations throughout the Garcia estuary.	2	5	CDFW, CDFW Law Enforcement, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-1.1.6.2	Action Step	Estuary	Identify and implement strategies to address point pollutant sources causing impairment to estuarine water quality conditions.	2	20	BLM, CDFW, Friends of the Garcia River, NMFS, NRCS, Private Landowners, RCD, The Nature Conservancy	
GarcR-NCSW-1.1.7	Recovery Action	Estuary	Enhance macro-invertebrate abundance and taxa richness				
GarcR-NCSW-1.1.7.1	Action Step	Estuary	Investigate and identify prey items/availability for rearing salmonids and the associated water quality conditions.	3	15	CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Consultants, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
GarcR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Conduct a Lower Garcia River off-channel low gradient habitat assessment targeting juvenile salmonid rearing requirements (biological performance criteria, i.e. reduced velocity targets relative to juvenile salmonids). Identify potential off-channel rehabilitation sites.	2	5	BLM, CDFW, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Work with landowners and encourage rehabilitation activities within the lower Hathaway Creek area in efforts to enhance backwater/off-channel and floodplain habitat for winter rearing salmonids.	2	100	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Identify, design, and implement rehabilitation projects that target winter rearing floodplain habitat within the lower reaches of the Garcia River.	2	5	CDFW, Mendocino Redwood Company, The Nature Conservancy	
GarcR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
GarcR-NCSW-3.1.1.1	Action Step	Hydrology	Map all water diversions (including illegal and legal) and upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	10	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, Private Landowners, SWRCB, The Nature Conservancy	
GarcR-NCSW-3.1.1.2	Action Step	Hydrology	Install and maintain stream gauges within the following tributaries that provide cold water to the Garcia River mainstem: Hathaway, North Fork, Rolling Brook, Mill Creek (lower Garcia River), South Fork, Signal, Mill Creek (upper Garcia River).	2	10	CDFW, NMFS, Private Landowners, SWRCB, The Nature Conservancy	
GarcR-NCSW-3.1.1.3	Action Step	Hydrology	Identify strategic locations and install off-channel storage facilities to reduce impacts associated with water diversions (e.g. storage tanks for rural residential users).	2	30	CDFW, NMFS, NRCS, Private Landowners, RCD, SWRCB	
GarcR-NCSW-3.1.1.4	Action Step	Hydrology	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	2	60	CalFire, CalTrans, CDFW, Mendocino County Department of Public Works, Private Landowners, RWQCB	Most diversions in the Garcia for dust control are for timber management actions. Most of these diversion have a Lake and Streambed Alteration Agreement with the Department of Fish and Wildlife and are likely incorporated into existing operations.

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-4.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-4.1.1	Recovery Action	Landscape Patterns	Prevent or minimize increased landscape disturbance				
GarcR-NCSW-4.1.1.1	Action Step	Landscape Patterns	Work with CDFW and TNC to designate the Garcia River as a protected "salmonid preserve".	2	100	CDFW, Conservation Fund, NMFS, NOAA RC, Private Landowners, State Parks, The Nature Conservancy, Trout Unlimited	
GarcR-NCSW-4.1.1.2	Action Step	Landscape Patterns	Should large tracts of forestlands within the Garcia River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or protected "salmonid preserve".	2	100	CDFW, Conservation Fund, NMFS, NOAA RC, Private Landowners, State Parks, The Nature Conservancy, Trout Unlimited	
GarcR-NCSW-4.1.1.3	Action Step	Landscape Patterns	Discourage counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CDFW, Mendocino County, NMFS, Sonoma County	
GarcR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
GarcR-NCSW-5.1.1.1	Action Step	Passage	Evaluate, design, and implement strategies to address potential impairment to passage due to vegetation encroachment or "choking" in Hathaway Creek. Ensure that winter rearing refuge for juvenile salmonids is optimized. Investigate habitat quality in upper Hathaway Creek.	2	5	BLM, CDFW, Friends of the Garcia River, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-5.1.1.2	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Bridge at Highway 1 on Hathaway Creek (Gasker Slough) (See CALFISH: PAD_ID 716762; Passage ID 26883).	3	5	CalTrans, CDFW, NMFS, USACE	
GarcR-NCSW-5.1.1.3	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Mill Creek (See CALFISH: PAD_ID 705892; Passage ID 7210)	3	5	CDFW, Mendocino County, NMFS, NOAA RC, Private Landowners, USACE	
GarcR-NCSW-5.1.1.4	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Mill Creek (See CALFISH: PAD_ID 705893; Passage ID 7211).	3	5	CDFW, Mendocino County, NMFS, USACE	
GarcR-NCSW-5.1.1.5	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713212; Passage ID 16600).	3	5	CDFW, Mendocino County, NMFS, Private Landowners, USACE	
GarcR-NCSW-5.1.1.6	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713213; Passage ID 16601).	3	5	CDFW, Mendocino County, NMFS, Private Landowners, USACE	
GarcR-NCSW-5.1.1.7	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Sled Creek (See CALFISH: PAD_ID 713211; Passage ID 16599)	3	5	CDFW, Mendocino County, USACE	
GarcR-NCSW-5.1.1.8	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Hathaway Creek (See CALFISH: PAD_ID 716763; Passage ID 26884).	2	5	CDFW, Mendocino County, NMFS, Private Landowners, USACE	
GarcR-NCSW-5.1.1.9	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at culvert on unnamed tributary to main stem Garcia River (See CALFISH: PAD_ID 723440; Passage ID 9522).	3	5	CDFW, Mendocino County, Private Landowners, USACE	
GarcR-NCSW-5.1.1.10	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at identified logjams throughout the Garcia watershed (only if necessary).	3	20	CDFW, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, Mendocino Redwood Company, NMFS, Private Landowners, USACE	
GarcR-NCSW-5.1.1.11	Action Step	Passage	Identify and prioritize all logjams that are complete or partial barriers and indicate passage impairment to specific life stage (Bell 2006, as cited by KrisWeb 2011).	3	20	CDFW, TNC, NOAA RC, RCD, Private Landowners	
GarcR-NCSW-5.1.1.12	Action Step	Passage	Ensure that all logjams are carefully modified and that all LWD remains in the active stream channel (Monschke and Caldon 1992).	3	30	CDFW, TNC, NOAA RC, RCD, Private Landowners	
GarcR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)				

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Increase wood frequency in spawning and rearing areas to the extent that a minimum of six key LWD pieces exists every 100 meters in 0-10 meters BFW streams.	2	10	CDFW, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Identify and install key LWD pieces in Rolling Brook to the extent that LWD frequency is optimized.	3	10	CDFW, NMFS, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 10-100 meters)				
GarcR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Increase wood frequency in seasonal habitat and migratory reaches to the extent that a minimum of 1.3 to 4 key LWD pieces exists every 100 meters in 10-100 meter BFW streams.	2	10	Board of Forestry, CalFire, CDFW, Conservation Fund, Friends of the Gualala River Watershed, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners, Public, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Target Signal Creek, North Fork Garcia, Rolling Brook, lower Mill Creek, Pardaloe, Blue Waterhole, Lanmour, and upper Mill Creek sub-basins as high priorities for LWD placement and rehabilitation work.	2	20	CDFW, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.2.3	Action Step	Habitat Complexity	Evaluate and implement strategies to rehabilitate LWD frequency and natural recruitment within the Garcia River main stem.	2	20	CDFW, Conservation Fund, Friends of the Garcia River, NMFS, NOAA RC, Private Landowners, Public, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.2.4	Action Step	Habitat Complexity	Identify strategic locations to install key LWD features in the SF Garcia mainstem to the extent that habitat complexity is optimized.	2	20	CDFW, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners, Public, Railroad, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.2.5	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	100	CalFire, CDFW, Private Landowners	
GarcR-NCSW-6.1.3	Recovery Action	Habitat Complexity	Increase primary pools frequency				
GarcR-NCSW-6.1.3.1	Action Step	Habitat Complexity	Increase the number of primary pools to the extent that more than 40% of summer rearing pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams.)	2	10	CDFW, Conservation Fund, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.3.2	Action Step	Habitat Complexity	Evaluate, develop, and implement strategies to increase primary pool frequency in high priority reaches within the following tributaries: Fleming Creek, Little SF Garcia, Signal Creek (and tribs).	2	20	CDFW, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter				
GarcR-NCSW-6.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter of 80 (See NMFS/CDFG criteria).	2	10	CDFW, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD, The Nature Conservancy	
GarcR-NCSW-6.1.4.2	Action Step	Habitat Complexity	Evaluate, identify, and improve shelters in pools within the mainstem Garcia River and the following tributaries: Blue Waterhole, Fleming Creek, Graphite Creek, Inman Creek, Little SF Garcia, NF Garcia, and Signal Creek (and tribs).	2	10	CDFW, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
GarcR-NCSW-7.1.1.1	Action Step	Riparian	Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.	2	20	Board of Forestry, CalFire, Conservation Fund, Mendocino Redwood Company, NMFS, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1.1.2	Action Step	Riparian	Plant and protect riparian vegetation, including redwood, on the lower 7 mile reach (Eureka Hill Road Bridge and Windy Hollow Road) or where necessary to provide the following: shade and lower water temperatures, cover, protection for fish, bank protection from erosion, and large organic debris in the future for habitat (Bell 2003).	2	10	Board of Forestry, CalFire, CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1.1.3	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy within the Blue Waterhole sub-basin.	2	20	Board of Forestry, CalFire, Conservation Fund, Mendocino Redwood Company, NMFS, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1.1.4	Action Step	Riparian	Minimize effects to existing native riparian vegetation where stream cover is provided.	2	20	Board of Forestry, CalFire, CDFW, Conservation Fund, NMFS, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
GarcR-NCSW-7.1.2.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	20	Board of Forestry, CalFire, Conservation Fund, NMFS, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	Board of Forestry, CDFW, Conservation Fund, NMFS, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-7.1.2.3	Action Step	Riparian	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	2	AC Alliance, Board of Forestry, Napa CFCWCD, NOAA RC, NOAA/NMFS, NRCS, The Nature Conservancy	
GarcR-NCSW-7.1.2.4	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Focus on partnerships with railroad and timber industry, as well as large private landowners.	3	20	CA Coastal Commission, California Coastal Conservancy, CDFW, Mendocino County, NMFS, NRCS, Private Landowners, RCD, Redwood Forest Foundation	
GarcR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-8.1.1	Recovery Action	Sediment	Improve and expand instream gravel quantity				
GarcR-NCSW-8.1.1.1	Action Step	Sediment	Conduct a habitat survey assessment to determine extent of embeddedness.				
GarcR-NCSW-8.1.1.2	Action Step	Sediment	Use the results of the habitat survey to identify areas with high embedeedness and implement gravel enhancement and sediment controls in those areas. Increase the percentage of gravel quality embeddedness to values of 1s and 2s (See NMFS Conservation Action Planning Attribute Table Report) in all current and potential juvenile salmonid summer and seasonal (fall/winter/spring) rearing areas.	2	20	CDFW, Conservation Fund, Friends of the Garcia River, NMFS, NOAA RC, RWQCB, The Nature Conservancy	
GarcR-NCSW-8.1.1.3	Action Step	Sediment	Identify and implement strategies to treat landslides and remediate historic features such as stream side landings and log landings (Bell 2003).	3	10	CDFW, Conservation Fund, Friends of the Garcia River, NMFS, NOAA RC, Private Landowners, RWQCB, The Nature Conservancy	
GarcR-NCSW-8.1.1.4	Action Step	Sediment	Complete the remaining 25% of erosion control sites identified in the South Fork Garcia River by the Trout Unlimited North Coast Coho Project.	2	5	CDFW, Mendocino Redwood Company, Trout Unlimited	
GarcR-NCSW-8.1.1.5	Action Step	Sediment	Treat high and medium priority sites that are identified in the MRC Garcia River Watershed Analysis, Garcia River Forest Integrated Resource Management Plan and other credible landowner assessments.	2	10	CDFW, NOAA RC, Private Consultants, Private Landowners, SWRCB	
GarcR-NCSW-8.1.1.6	Action Step	Sediment	Acquire funding for assessment and implementation of sediment reduction measures associated with the 2008 Jacks Fire which occurred in the North Fork Garcia River subbasin.	2	2	CalFire, NRCS, Private Landowners, RCD	

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-8.1.1.7	Action Step	Sediment	Continue the implementation of the Garcia River TMDL and associated sediment reduction efforts.	2	20	Board of Forestry, CalFire, CDFW, NMFS, NOAA RC, RWQCB, The Nature Conservancy	
GarcR-NCSW-8.1.1.8	Action Step	Sediment	Develop and implement bank erosion prevention and riparian planting in Pardaloe Creek (Monschke and Caldon 1992).	2	10	CDFW, Conservation Fund, NMFS, NOAA RC, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
GarcR-NCSW-10.1.1.1	Action Step	Water Quality	Work with TNC and Stillwater Sciences to develop a "Basin Temp" model to aid in efforts to reduce stream temperatures between Signal and the Pardaloe/Mill creeks confluence.	2	10	CDFW, Conservation Fund, NMFS, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-10.1.1.2	Action Step	Water Quality	Work with landowners to plant riparian zones of Blue Waterhole, Inman Creek, and Pardaloe Creek with the goal of reducing instream water temperatures of the Garcia River main stem during the dry season.	2	10	CDFW, NOAA RC, Private Landowners	
GarcR-NCSW-10.1.1.3	Action Step	Water Quality	Identify and Implement actions to maintain and restore water temperatures to meet habitat requirements for salmonids in specific streams (CDFG 2004).	2	10	CDFW, CDFW Law Enforcement, NMFS OLE, NOAA RC, NOAA/NMFS, Private Landowners, RCD	
GarcR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
GarcR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
GarcR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFW to modify California code of Regulations Title 14, Section 8.00(b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties to close fishing during periods of low flow. Discontinue using the Russian River at Guerneville gauging station for angling closures and use the Navarro River USGS gauging station (11468000) which better reflects hydrologic conditions in smaller unregulated coastal Sonoma/Mendocino streams.	2	30	CDFW, NMFS	
GarcR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult salmonids by increasing law enforcement.	1	100	CDFW, NOAA/NMFS	
GarcR-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	2	100	CDFW, DFG, NOAA/NMFS	
GarcR-NCSW-16.2	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**				
GarcR-NCSW-16.2.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
GarcR-NCSW-16.2.1.1	Action Step	Fishing/Collecting	Investigate and consult with local tribal officials in efforts to stop or minimize tribal gill-netting in the Garcia River watershed.	1	30	CDFW, CDFW Law Enforcement, NMFS OLE, NOAA/NMFS, Pomo Tribe, TNC	
GarcR-NCSW-16.2.1.2	Action Step	Fishing/Collecting	Continue to work with CDFW, stakeholders and tribal officials on Implementation of the *Resolution of the Business Committee of the Manchester-Point Arena Band of Pomo Indians for the Protection of Garcia River Endangered Species (Resolution No. #327-11-07-2014).*	1	30	CDFW, CDFW Law Enforcement, NMFS OLE, NOAA/NMFS, Pomo Tribe, TNC	
GarcR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to estuary quality and extent				
GarcR-NCSW-18.1.1.1	Action Step	Livestock	Work with BLM to ensure that future cattle leasing agreements do not reduce potential rehabilitation of high value summer and winter juvenile salmonid rearing habitat within the lower Garcia River and estuary.	2	20	BLM, CDFW, NOAA RC, NOAA/NMFS	
GarcR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to water quality (instream water temperature)				

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-19.1.1.1	Action Step	Logging	Protect current riparian zones in all summer salmonid rearing areas to the extent that they are able to mature, provide, and maintain a minimum of 80% canopy cover.	2	50	Board of Forestry, CalFire, CDFW, Conservation Fund, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners, RWQCB, The Nature Conservancy	
GarcR-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
GarcR-NCSW-19.1.2.1	Action Step	Logging	Ensure future forest management allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	2	100	CDFW, Conservation Fund, Mendocino Redwood Company, NMFS, RWQCB, The Nature Conservancy	
GarcR-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GarcR-NCSW-19.1.3.1	Action Step	Logging	Develop and implement low impact timber and wood harvest techniques (e.g., full-suspension cable yarding) in efforts to reduce turbidity impacts in streams. Example: Parker Ranch in the Ten Mile River Basin (Bell 2003).	2	100	Board of Forestry, CDFW, Conservation Fund, Mendocino Redwood Company, Private Landowners, RWQCB, The Nature Conservancy	
GarcR-NCSW-19.1.3.2	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	2	60	CalFire	
GarcR-NCSW-19.1.3.3	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	20	CalFire, Mendocino Redwood Company, NOAA RC, Private Landowners	
GarcR-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
GarcR-NCSW-19.1.4.1	Action Step	Logging	Areas adjacent to currently owned State parks or forestlands supporting essential or supporting populations should be considered for purchase (if feasible within the next 5 years).	2	50	CDFW, NMFS, Private Landowners, Redwood Forest Foundation, The Nature Conservancy, Trout Unlimited	
GarcR-NCSW-19.1.4.2	Action Step	Logging	Should large tracts of forestlands within the Garcia River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or protected "salmonid preserve".	2	50	CDFW, NMFS, Redwood Forest Foundation, RWQCB, The Nature Conservancy	
GarcR-NCSW-19.1.4.3	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	2	20	CDFW, NMFS, Private Landowners	
GarcR-NCSW-19.1.4.4	Action Step	Logging	Maintain and expand California's working forestlands and forestlands held by the State, and minimize future conversion of forestlands to agriculture or other land uses.	2	20	Board of Forestry, CalFire, CDFW, NMFS, RWQCB	
GarcR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
GarcR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
GarcR-NCSW-19.2.1.1	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	20	Board of Forestry, CA Coastal Commission, CDFW, NMFS	
GarcR-NCSW-19.2.1.2	Action Step	Logging	Work with the California Board of Forestry to design and implement a program of BMPs for logging areas that meets the approval of NMFS and CDFW.	3	20	Board of Forestry, CDFW, NMFS, RWQCB	
GarcR-NCSW-19.2.1.3	Action Step	Logging	Conduct an assessment of the mechanisms driving forestland conversion and develop strategies to protect forestlands.	3	10	Board of Forestry, Mendocino County, NMFS	
GarcR-NCSW-19.2.1.4	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFW Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	2	20	Board of Forestry, CDFW, NMFS	
GarcR-NCSW-19.2.1.5	Action Step	Logging	Establish a scientific framework for monitoring the effectiveness of practices in meeting watershed process goals and a decision-making process that is adaptive to the new information.	2	30	Board of Forestry, CalFire, CDFW, Conservation Fund, Mendocino Redwood Company, NMFS, Private Landowners	
GarcR-NCSW-19.2.1.6	Action Step	Logging	Provide information to BOF regarding salmonid recovery priorities identified in the Plan, and recommend upgrading relevant forest practices to minimize adverse effects of timber harvest.	2	2	CDFW, NMFS	
GarcR-NCSW-19.2.1.7	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CA Coastal Commission, CDFW, Mendocino County, NMFS	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-19.2.1.8	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	2	5	Board of Forestry, CalFire, CDFW, NMFS	
GarcR-NCSW-19.2.1.9	Action Step	Logging	Develop a California Forest Practice monitoring protocol to determine whether specific practices are effectively meeting intended objectives and are providing for the protection of salmonids.	3	20	Board of Forestry, CalFire, NMFS, NRCS, RCD, RWQCB, The Nature Conservancy	
GarcR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GarcR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats.	2	10	Board of Forestry, CalFire, Mendocino County, NMFS, NOAA RC, RWQCB	
GarcR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Map and identify stream crossings with the intention of replacement or removal if they cannot pass the 100 year flow. Designs should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	10	CDFW, Mendocino County Department of Public Works, NOAA RC, NRCS, Private Landowners, RCD	
GarcR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	10	CalFire, CDFW, Mendocino County Department of Public Works, NRCS, Private Landowners	
GarcR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).	2	20	CDFW, NOAA RC, NRCS	
GarcR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	20	CalFire, CDFW, NOAA RC, NRCS, Private Landowners, RCD	
GarcR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	20	CalFire, CDFW, NOAA RC, NRCS, Private Landowners, RCD	
GarcR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
GarcR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	3	5	CalFire, Mendocino County Department of Public Works, NMFS, Private Landowners	
GarcR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	2	10	CDFW, Mendocino County, NOAA RC, NRCS, Private Landowners	
GarcR-NCSW-23.1.2.3	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	3	20	Mendocino County, NMFS, NRCS, Private Landowners, RCD	
GarcR-NCSW-23.1.2.4	Action Step	Roads/Railroads	Evaluate existing and future stream crossings that impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	10	Board of Forestry, CalFire, CDFW, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GarcR-NCSW-23.1.2.5	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	5	CalFire, CalTrans, CDFW, NMFS, NRCS, Private Landowners	
GarcR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
GarcR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalTrans, Mendocino County Department of Public Works	
GarcR-NCSW-23.1.3.2	Action Step	Roads/Railroads	Ensure that all future road or bridge repairs at stream crossing provide unimpaired fish passage for all salmonid life stages.	2	20	Mendocino County	
GarcR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (stream flow)				

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	20	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, RWQCB, SWRCB	
GarcR-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GarcR-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
GarcR-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Minimize impacts to flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	2	20	CDFW, NMFS, SWRCB	
GarcR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	20	CDFW, NOAA RC, Private Landowners, SWRCB	
GarcR-NCSW-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration				
GarcR-NCSW-25.1.2.1	Action Step	Water Diversion/ Impoundment	Establish flow related adult and smolt migration thresholds to consider in authorizing future water diversions.	2	20	CDFW, CDFW Law Enforcement, NMFS OLE, NMFS, SWRCB	
GarcR-NCSW-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (quality and extent)				
GarcR-NCSW-25.1.3.1	Action Step	Water Diversion/ Impoundment	Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months (ECORP and Kamman Hydrology & Engineering 2005).	2	20	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
GarcR-NCSW-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (instream temperature)				
GarcR-NCSW-25.1.4.1	Action Step	Water Diversion/ Impoundment	Minimize impairment of instream water temperatures resulting from diversions during the summer and fall dry seasons.	2	50	CA Coastal Commission, CWQCB, NMFS OLE, NOAA/NMFS, Pomo Tribe, Private Landowners, RCD, WCB	
GarcR-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
GarcR-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
GarcR-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	10	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
GarcR-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	100	CDFW, NMFS, NRCS, SWRCB	
GarcR-NCSW-25.2.1.3	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	50	CDFW, NMFS, SWRCB	
GarcR-NCSW-25.2.1.4	Action Step	Water Diversion/ Impoundment	Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	3	30	SWRCB	
GarcR-NCSW-25.2.1.5	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	20	CDFW, CDFW Law Enforcement, NMFS OLE, NMFS, SWRCB	

Garcia River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GarcR-NCSW-25.2.1.6	Action Step	Water Diversion/ Impoundment	Support the SWRCB in regulating groundwater.	3	20	CDFW, NMFS, RWQCB	
GarcR-NCSW-25.2.1.7	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of salmonids and authorized diverters (CDFG 2004).	2	20	CDFW, NMFS, SWRCB	

Gualala River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Central Coastal
- Spawner Abundance Target: 7,900 adults
- Current Intrinsic Potential: 396.7 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Insufficient information exists from which to determine quantitatively the current abundance and distribution of steelhead within the Gualala River watershed (CRWQCB 2001). Past and recent accounts of steelhead within the watershed do suggest the population is currently self-sustaining, but numbers of returning adult steelhead are highly variable and possibly declining. Estimates from 1970s CDFW creel and mark-and-recapture surveys conducted in the lower river reported a wide range of returning adult steelhead among years (571 to 10,379), a substantial decline from the reported CDFW mid-1960s estimates of 16,000 returning adult steelhead (CRWQCB 2001). Recent annual spawning surveys conducted in the 2000s (2002-2010) within the Wheatfield Fork counted a low of 126 adult steelhead in 2010, and a high of 1,402 in 2008 (DeHaven 2010). A recorded low of 31 adult steelhead were counted by DeHaven during multiple spawning surveys conducted within a shortened survey reach of Wheatfield Fork in 2010.

Steelhead remain well distributed throughout the watershed, as current reports of juvenile steelhead distribution are consistent with historical accounts (CRWQCB 2001). However, juvenile steelhead densities, and the extent in which they inhabit tributaries during the dry months, vary. Juvenile steelhead electro-fishing surveys conducted by CDFW from 1988 to 1998 within the lower and upper Little North Fork Gualala River reported a range of 0.19 to 1.49 steelhead/m^2. DeHaven (2008) reported high densities (3.7 steelhead/linear ft.) of juvenile steelhead during snorkel surveys in selected reaches of the Wheatfield Fork in June of 2008, however, due to lower than normal summer flows, densities had decreased to 0.6 steelhead/ft) by late August.

History of Land Use

The first documented accounts of logging of old growth redwoods date back to 1862 in lower portions of the watershed (Klamt *et al.* 2003). By 1965, aerial photos of the watershed show large areas denuded of trees and scarred by roads and skid trails. Logging and clearing of dense conifer and woodland areas was frequently followed by prolonged cattle grazing. Following slowed periods of logging in the 1970s and 1980s, timber harvest activity again increased in the 1990s. During the 1990s, smaller but numerous clear-cut blocks appeared in the redwood lowland areas under Gualala Redwoods, Inc. ownership (Klamt *et al.* 2003). There is also a history of instream gravel mining that has been conducted in the South and Wheatfield Forks of the Gualala River.

Current Resources and Land Management

Currently, greater than 99 percent of the Gualala River watershed is privately owned. Of that, approximately 34 percent is owned by four timber companies: The Conservation Fund, Gualala Redwoods, Soper Wheeler Company, and Mendocino Redwood Company. Over the past 20 years, 54 percent of the watershed has been under a Timber Harvest Plan. As such timber production remains the primary land use in the Gualala River watershed today, along with grazing and rural residential development (USEPA 2001). Vineyards are also present within the watershed, and more recently, large forestland-to-vineyard land conversions have been proposed. Instream gravel mining is also conducted in the watershed.

A TMDL aimed at addressing sediment impairments, water temperatures, and water quality was developed by the USEPA in 2001 and adopted by the North Coast Regional Water Quality Control Board in 2004. Other stakeholders within the watershed include the Gualala River Watershed Council and Friends of the Gualala River, who are both very active in grassroots watershed protection. These grass-root groups are successful in working with landowners in reducing excessive fine sediment into adjacent waterways, placing LWD in streams, and conducting natural resource-type research in many areas of the Gualala River watershed. In 2003, the North Coast Watershed Assessment Program completed the Gualala River Watershed Assessment. The following pertinent documents are available for the Gualala River watershed:

- Draft North Fork Gualala River Reconnaissance Assessment and Study Plan (Stillwater Sciences 2012);
- Gualala Estuary and Lower River Enhancement Plan: Results of 2002 and 2003 Physical and Biological Surveys (ECORP and Kamman Hydrology & Engineering 2005);
- North Coast Watershed Assessment Program (Klamt *et al.* 2003);
- Gualala River Watershed Technical Support Document For Sediment (CRWQCB 2001);
- Gualala River Total Maximum Daily Load (USEPA 2001);

- Adult and Juvenile Steelhead Population Surveys, Gualala River, CA (DeHaven 2002; DeHaven 2003; DeHaven 2004; DeHaven 2005; DeHaven 2007; DeHaven 2008; DeHaven 2010); and
- Preservation Ranch Limiting Factors Analysis. Final Report (Stillwater Sciences 2008).

Salmonid Viability and Watershed Conditions

The following indicators are rated Poor through the Conservation Action Planning (CAP) process (see Gualala River CAP results) for steelhead: pool shelter, primary pools, pool/riffle/run ratio, impaired hydrology (passage flow for smolts), stream side road density, water temperature, and summer juvenile steelhead reduced density and abundance. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Gualala River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Riparian Vegetation: Composition, Cover and Tree Diameter

Current riparian canopy generally consists of mid-sized 40-year-old second growth coniferous or mixed conifer/hardwood stands in the middle to upper reaches of the Gualala River watershed (NCWAP 2003). Riparian oak savanna reaches have not re-established since initial logging, most likely due to over grazing, slop instability, and high air temperatures (Klamt *et al.* 2003). Overall, watershed-wide riparian canopy cover has improved since the 1960s, but has not recovered to levels observed in 1942 when canopy cover was complete and had recovered from early 1900s logging in most areas. Canopy cover is a significant factor influencing stream water temperatures.

Water Quality: Temperature

Water temperature information provided by the Gualala River Watershed Council and Gualala Redwoods, Inc., as reported in the Klamt *et al.* (2003), indicated a linear relationship between higher temperatures and lower canopy values. Water temperatures are considered suitable for summer rearing steelhead in smaller tributaries where data was available (Klamt *et al.* 2003). However, temperatures were considered unsuitable in the mainstem and most sub-basins overall (Klamt *et al.* 2003; DeHaven 2011). Furthermore, high stream temperatures in low gradient reaches that flow through oak woodland forests may be limiting juvenile steelhead production with the Buckeye creek watershed (Stillwater Sciences 2008).

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios and Habitat Complexity: Large Wood and Shelter

CDFW habitat surveys conducted in 2002 and 2004 indicated lacking pool shelter, habitat complexity, and less than desirable riffle/pool/flatwater ratios in many tributaries. Habitat complexity has been lost in many streams due to poor abundance of channel forming features (*e.g.*, LWD, boulders, *etc.*), channel simplification, and sediment aggradation, which are all associated with past logging and wood harvest activities. In addition, riparian zones degraded by past logging have severely limited the natural recruitment of LWD in many historically productive streams within the Gualala River watershed, limiting the quality of juvenile rearing habitat in many areas of the watershed. Gualala Redwoods, Inc. and their partners have embarked on many instream large wood placement projects, which have improved habitat complexity in some areas. However, many other stream reaches will require similar supplementation of LWD, boulders and other channel forming features to encourage more desirable pool/riffle ratios (including primary pools) and increase pool shelter ratings. High priority sub-basins within the Gualala River watershed in need of LWD placement include: NF Gualala River, Rockpile, Buckeye, Wheatfield Fork, and SF Gualala River. Rehabilitating these streams will greatly improve the quality of available spawning and seasonal rearing habitat potential for steelhead.

Hydrology: Baseflow and Passage Flows

Seasonal impairments in water flow have been noted in the Gualala River specifically during the spring and summer months (DeHaven 2004). As streamflow recedes during these months, the quality and extent of fry and juvenile rearing habitat diminishes particularly in areas that lack significant instream cover (Stillwater Sciences 2012). The interface of reduced spring and summer streamflow with reduced instream cover has been observed throughout the Gualala River watershed. Dehaven (2004) observed 4th and 5th order sections of the Wheatfield Fork becoming dry or intermittent during a year with average rainfall, which is a rare occurrence based on his observations. In the North Fork Gualala, Stillwater Sciences (2012) found that where instream habitat was lacking, summer rearing for juvenile steelhead decreased substantially relative to more complex habitats as streamflow declined from 9.4 cfs to 3.0 cfs.

Estuary: Quality and Extent

Under existing conditions, steelhead rearing capacity in the coastal Gualala estuary is generally good for pre-smolts and smolt steelhead (ECORP and Kamman Hydrology & Engineering 2005). However, how much of the historic extent of the estuary has been lost or filled due to excessive sediments loads resulting from past and current logging and agricultural activities is unclear. Investigations should be conducted to assess if the estuary is "filling" or "recovering" from these past impacts. Designing and implementing habitat complexity features (*e.g*., LWD, boulder, *etc*.) that encourage deeper pools and provide shelter may significantly improve the rearing capacity of the estuary regardless of its historic depth and condition. Furthermore, the current quality and extent of the estuary for seasonal (March 15 to November 15) juvenile steelhead rearing is controlled by hydrologic and water quality characteristics. Therefore, any change to timing or magnitude of any given characteristic (*e.g*., summer inflow) or physical process brought about by human activities within the estuary or upstream may significantly impact estuary health and ecology (ECORP and Kamman Hydrology & Engineering 2005). Specific physical parameters (water quality, sediment transport, *etc*.) that influence the quality of rearing conditions for salmonids within the estuary should be continuously monitored.

Threats

The following discussion focuses on those threats that were rated as High or Very High. Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Gualala River CAP results.

Logging and Wood Harvesting

Early logging activities left a legacy of impacts, some of which persist today (Klamt *et al.* 2003). Splash dams and log drives tended to flatten and simplify stream channels. Watercourses were frequently used as skid paths to move logs downslope including the use of splash dams (Klamt *et al.* 2003). More recent data reported by KRIS Gualala[1] showed that timber harvest rates between 1991 and 2001 were Very High (>30-percent of a watershed area in less than 10-years) in some areas of the Gualala River watershed. Other reports indicate that 50 percent of the combined area of Annapolis, Little and Grasshopper creeks was disturbed by timber harvest between 1991 and 2008 (Higgins 2009). Past and present impacts associated with logging include: reduced canopy cover resulting in increased stream water temperatures, increased sediment load into adjacent waterways impairing gravel quality in downstream reaches, and significant loss of LWD recruitment, which is an essential component of habitat complexity, form and function. Although logging has improved compared to historical practices, habitat degradation from past logging and potential impacts associated with future logging will continue to threaten the recovery of steelhead and their habitat.

Water Diversions and Impoundments

Currently, there are no large long standing dams within the Gualala River watershed. Based on existing water rights, land use data, and observations reported by CDFW during instream field

[1] http://www.krisweb.com/krisgualala/krisdb/html/krisweb/

surveys conducted in 2001, water diversions within the watershed do not appear to significantly affect streamflows. However, most active diversions within the watershed are not monitored and the resulting impacts on streamflow have not been evaluated or recorded (Klamt *et al.* 2003). DeHaven (2008; 2010) reported severe dewatering in some years within the Wheatfield Fork sub-basin and near its confluence with the SF Gualala River. The North Fork Gualala River has been identified as an important source of baseflow to the lower Gualala River and estuary during late season periods (Klamt *et al.* 2003).

The current quality and extent of the estuary for seasonal (March 15 to November 15) juvenile steelhead rearing is controlled by hydrologic and water quality characteristics. Increases in water diversions have the potential to not only adversely affect the timing, but also reduce the magnitude of freshwater flow entering the estuary and thus result in a significant impact on the health and ecology in the estuary. Therefore, further reductions in flow during the spring and summer, caused by water diversions and impoundments, pose a significant threat for not only salmonids rearing in sub-basins within the watershed (Klamt *et al.* 2003), but also for juvenile rearing within the estuary (ECORP and Kamman Hydrology & Engineering 2005).

Agriculture

Vineyards pose one of the most serious threats to the Gualala River's steelhead and ecosystem (DeHaven 2011). Vineyards are becoming more widespread throughout the watershed, and larger forestland-to-vineyard conversions are being proposed. Large portions of the Wheatfield Fork near Annapolis have already been converted or are proposed for conversion to vineyards, and other proposals to convert portions of Grasshopper, Buckeye, and Patchett creeks are underway (Friends of the Gualala River 2011). The heaviest vineyard water usage is during the spring and summer months when young steelhead are emerging from the gravel, smolts are emigrating to the ocean, and steelhead parr are rearing within available summer habitat. Reduced surface and groundwater from these sub-basins could not only impair summer baseflows in these tributaries, but also could impair inflow and water quality conditions within the Gualala estuary. Forestland-to-vineyard conversions are also noted as being potentially more severe to the landscape than past logging practices. The forestland-to-vineyard conversion process includes clear cutting of forestlands, deep ripping of the soil, and increase ground and surface water use, all which result in the permanent conversion of complex forest ecosystems (Friends of the Gualala River 2011).

Roads and Railroads

Roads and railroads associated with past logging included massive cut and fill excavation along stream banks and within the active stream channel. Many of these roads had and still have steep gradients designed to access all positions of the side slope. Skid trails frequently followed or crossed ephemeral stream channels (Klamt *et al.* 2003). Roads and landings adjacent to watercourses were constructed by pushing woody debris into the channel and overtopping with dirt and fill. These road-associated impacts contributed to massive instream aggradation, and degraded spawning gravel quality in many streams. Further, annual blading or maintenance of dirt roads in the watershed provided a chronic source of fine sediment to tributaries in the Gualala. On December 20, 2001, the USEPA established a sediment TMDL for the Gualala River based on the information provided in the Gualala Technical Support Document (CRWQCB 2001). The TSD listed eight current sediment sources with the basin, six of which are associated with roads: road mass wasting, bank erosion, surficial road erosion, road gullies, road-stream crossing failures, and skid trails. Additionally, some roads impair upstream steelhead passage at stream crossings (Fuller Creek PAD_ID 736904) (Franchini Creek), and many still need to be remedied. Although current road standards have improved, the many remaining legacy roads, the associated road maintenance of existing roads, and the expected construction of new roads near watercourses will remain a current and future threat to the recovery of steelhead and their habitat within the Gualala river watershed.

Fishing and Collecting

Current low flow regulations on the Gualala River are based on the Russian River Hacienda stream gage. Unlike the Gualala River and other adjacent coastal watersheds, the Russian River has two large reservoirs that regulate streamflows, and is operated for flood control during the wet months. These regulated operations often slow descending hydrologic conditions, resulting in higher prolonged and sustained streamflows. These conditions do not accurately reflect unregulated hydrologic conditions of the Gualala River and other adjacent coastal streams. Adopting a more appropriate low flow fishing closure that protects all salmonids and better reflects hydrologic conditions in the Gualala River watershed is needed.

Limiting Stresses, Lifestages, and Habitats

The summer juvenile steelhead lifestage is the most limited in the Gualala River watershed. Impaired canopy cover, reduced habitat complexity, and increased water temperatures coupled with reduced surface flow, are the stresses most limiting summer juvenile survival and ultimately recovery of steelhead within the Gualala River watershed.

General Recovery Strategy

Improve Canopy Cover and Reduce Stream Water Temperature

Stream canopy conditions have improved within many small streams of the Gualala River watershed and will continue to improve in areas that are protected from future logging and forestland-to-vineyard conversions. However, in many low-gradient areas riparian rehabilitation efforts need to be implemented to improve the extent and quality of summer rearing conditions within the watershed.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios and Habitat Complexity: Large Wood and Shelter

Pool shelter levels and primary pool frequency are poor in most every tributary in the Gualala River watershed. Strategically placing channel forming features in high priority reaches of the NF Gualala, Rockpile, Buckeye, Wheatfield Fork, and SF Gualala sub-basins will increase surface water hydrologic connectivity in highly aggraded reaches and consequently increase summer rearing habitat capacity. Additionally, establishing appropriate size riparian buffer zones or improving management within those buffers throughout the watershed will increase stream shading and promote natural LWD recruitment.

Protect Seasonal and Summer Hydrologic Conditions

With physical habitat features improving and slowly recovering in many portions of the watershed, protecting spring and summer hydrologic conditions will be essential for the recovery of all salmonids in the Gualala River. The proposed establishment of large vineyards is an exceptionally high threat due to potential reductions in the groundwater table and surface flow. Lower surface flows will not only limit the current extent of summer steelhead rearing within the basin, but may seriously impair the quality of seasonal rearing conditions in the estuary.

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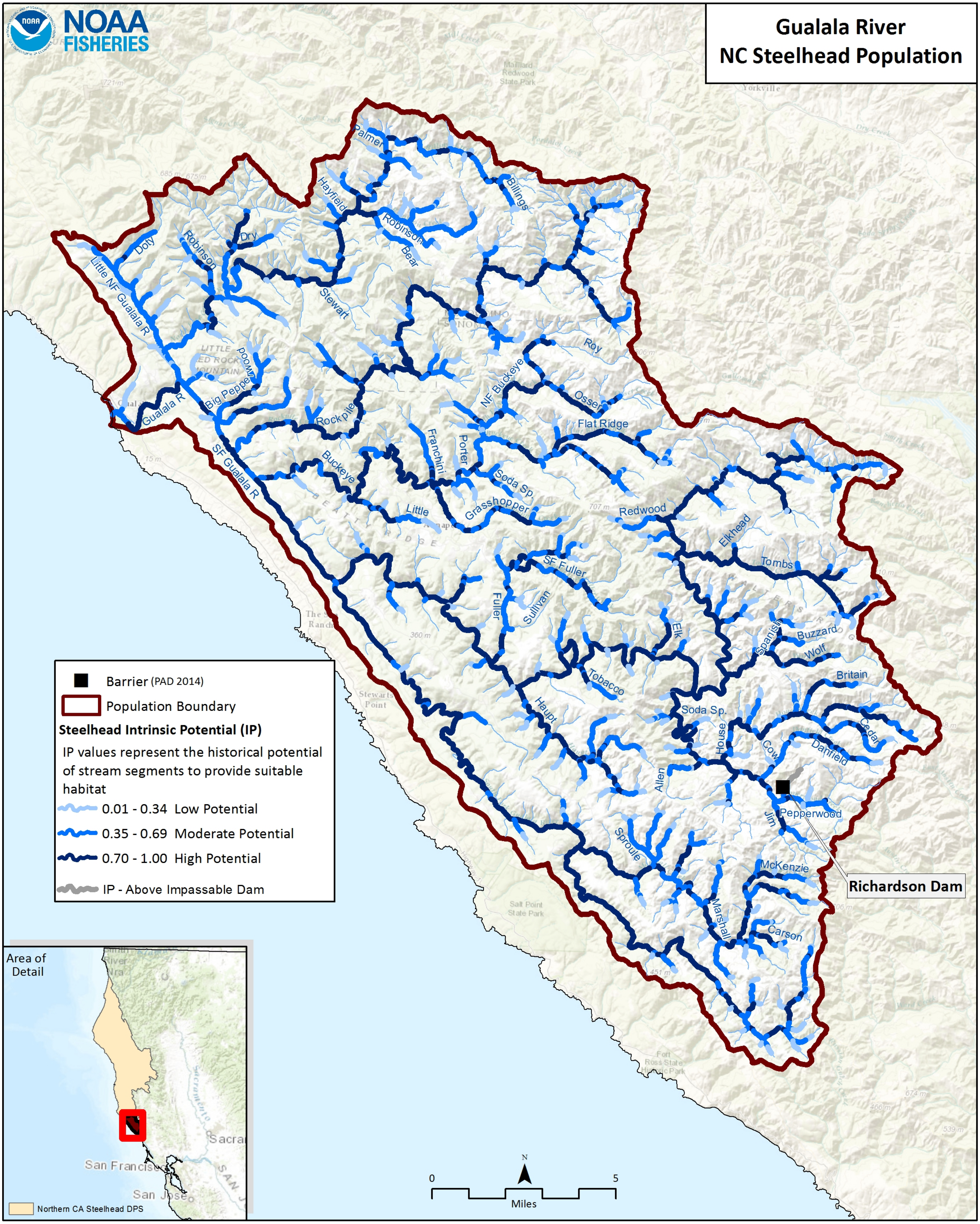

NOAA FISHERIES
Gualala River
NC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
Richardson Dam
Palmer
Hayfield
Billings
Robinson
Bear
Dry
Doty
Little NF Gualala R
Stewart
Roy
Wood
Big Pepper
Gualala R
NF Buckeye
Osser
Flat Ridge
Rockpile
Franchini
Porter
SF Gualala R
Buckeye
Soda Sp
Grasshopper
Little
Redwood
Elkhead
Tombs
SF Fuller
Fuller
Sullivan
Elk
Spanish
Buzzard
Wolf
Britain
Tobacco
Haupt
Soda Sp.
House
Cow
Cedar
Danfield
Allen
Pepperwood
Jim
Sproule
McKenzie
Marshall
Carson
Area of Detail
Northern CA Steelhead DPS
0
5
Miles
N

NC Steelhead Gualala River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>6 Key Pieces/100 meters)	Good
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	48% streams/ 37% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	8% streams/ 2% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	Good
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	63% streams 70% IP-km (>50% stream average scores of 1 & 2)	Fair

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>6 Key Pieces/100 meters)	Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	23% streams 25% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	48% streams/ 37% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	8% streams/ 2% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.15 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% streams/ 14% IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	63% streams 70% IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>6 Key Pieces/100 meters)	Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	48% streams/ 37% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	8% streams/ 2% IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	39% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	63% streams 70% IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	8% streams/ 2% IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.15 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.101% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.548% % of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	2% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.9 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.0 Miles/Square Mile	Fair

NC steelhead Gualala River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Medium	Medium	Medium	Medium	Medium	Medium	Medium
2	Channel Modification	Low	Low	Medium	Low	Low	Medium	Medium
3	Disease, Predation and Competition	Low	Low	Low	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Medium		Low		Low		Low
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Medium	Medium	Medium	Medium	Low	Medium	Medium
8	Logging and Wood Harvesting	High	Medium	High	High	High	High	High
9	Mining	Low	Low	Low	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Low	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Low	Medium	Low	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Medium	Medium	High	Medium

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-1.1.1	Recovery Action	Estuary	Increase the physical extent of estuarine habitat				
GualR-NCSW-1.1.1.1	Action Step	Estuary	Investigate the extent of sedimentation within the estuary/lagoon associated with watershed legacy impacts (logging). Evaluate sediment transport within the estuary and determine if the estuary is "filling" with sediment or "flushing" sediment (recovering).	3	10	CDFW, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GualR-NCSW-1.1.1.2	Action Step	Estuary	Identify past mechanical fill sites (inside of Mill Bend) and develop strategies targeting the re-establishment of wetland marsh habitat (if feasible).	3	10	CDFW, NMFS, NOAA RC, NRCS, RCD	
GualR-NCSW-1.1.1.3	Action Step	Estuary	Develop and implement rehabilitation projects designed to increase the physical extent of high quality habitat for rearing juvenile salmonids within the Gualala River estuary.	3	10	CDFW, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners	
GualR-NCSW-1.1.1.4	Action Step	Estuary	Investigate the historical functions and ecology of the estuary	3	10	CDFW, Gualala Watershed Council	
GualR-NCSW-1.1.2	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features				
GualR-NCSW-1.1.2.1	Action Step	Estuary	Increase the percentage of area containing high value habitat complexity elements and features (SAV, LWD, boulders, marshes, vegetation, pools > 2 meters).	2	10	CDFW, Gualala Watershed Council	
GualR-NCSW-1.1.2.2	Action Step	Estuary	Identify strategic locations to install LWD structures designed to increased pool depth and habitat conditions within the Gualala River estuary.	2	10	CDFW, Gualala Watershed Council	
GualR-NCSW-1.1.3	Recovery Action	Estuary	Improve the quality of freshwater lagoon habitat				
GualR-NCSW-1.1.3.1	Action Step	Estuary	Install continuous water quality monitoring stations in the Gualala estuary during the summer months. Monitor at a minimum temperature, dissolved oxygen, and salinity.	2	5	CDFW, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, RCD, RWQCB	
GualR-NCSW-1.1.4	Recovery Action	Estuary	Improve freshwater inflow				
GualR-NCSW-1.1.4.1	Action Step	Estuary	Install a stream gauge immediately upstream of the estuary/lagoon to monitor inflow conditions during the dry season.	2	5	CDFW, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RWQCB	
GualR-NCSW-1.1.4.2	Action Step	Estuary	Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions relative to juvenile salmonid estuarine summer rearing (osmo-regulating and non-osmoregulating).	2	10	CDFW, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, RCD, RWQCB, SWRCB	
GualR-NCSW-1.1.4.3	Action Step	Estuary	Develop a stream flow model to identify and implement a minimum freshwater inflow threshold to ensure optimal estuary health and function for rearing salmonids.	2	5	CDFW, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, RWQCB, SWRCB	
GualR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
GualR-NCSW-3.1.1.1	Action Step	Hydrology	Continue to work with the North Gualala Water Company on water right Permit 14853. Ensure that the Site-specific Study Plan prepared for the NGWC by Stillwater Sciences (11 October 2011) is completed within the next 3-yrs. Implement recommendations within the next 5-years. Ensure salmonid life history requirements targeted in the proposal are evaluated under a range of water year types (dry - wet). Evaluate potential impacts to dry season estuary water quality conditions associated with Permit 14853.	2	20	CDFW, CDFW Law Enforcement, Gualala Watershed Council, NMFS, NMFS OLE, North Gualala Water Company, SWRCB	
GualR-NCSW-3.1.1.2	Action Step	Hydrology	Map all water diversions and upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	60	CDFW, NMFS, North Gualala Water Company, Private Landowners, Sea Ranch, SWRCB	
GualR-NCSW-3.1.1.3	Action Step	Hydrology	Monitor, identify problems, and prioritize needed changes to permitted water diversions on current or potential steelhead streams.	2	10	BLM, CDFW, NMFS, North Gualala Water Company, Private Landowners, Sea Ranch, SWRCB	Problems should be identified through mapping diversion and developing stream flow model.

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-3.1.1.4	Action Step	Hydrology	Install and maintain a gauging station immediately upstream of the estuary to monitor freshwater inflow during the dry season.	2	10	CDFW, NMFS, USGS	Provide consistent funding for the North Fork Gualala River and possible funding for the Wheatfield Forks of the Gualala River.
GualR-NCSW-3.1.1.5	Action Step	Hydrology	Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the dry season.	1	5	CDFW, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, RCD, RWQCB, Sea Ranch, SWRCB	
GualR-NCSW-3.1.1.6	Action Step	Hydrology	Install and maintain a stream gauge at an appropriate location near the base of Rockpile Creek.	3	10	CDFW, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, RWQCB, SWRCB	
GualR-NCSW-3.1.1.7	Action Step	Hydrology	Install and maintain a stream gauge at an appropriate location near the base of Buckeye Creek.	3	5	CDFW, NMFS, NRCS, Private Landowners, RCD, SWRCB	
GualR-NCSW-3.1.1.8	Action Step	Hydrology	Install and maintain a stream gauge at an appropriate location immediately downstream of the SF Gualala and Wheatfield Fork confluence.	3	10	CDFW, Gualala Watershed Council, NMFS, NRCS, Private Landowners, RCD, Sea Ranch, SWRCB	
GualR-NCSW-3.1.1.9	Action Step	Hydrology	Evaluate and implement off-channel storage facilities to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the NF Gualala and Wheatfield sub-watersheds.	2	20	CDFW, Gualala Watershed Council, NMFS, North Gualala Water Company, NRCS, SWRCB	
GualR-NCSW-4.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GualR-NCSW-4.1.1	Recovery Action	Landscape Patterns	Prevent or minimize increased landscape disturbance				
GualR-NCSW-4.1.1.1	Action Step	Landscape Patterns	Consider developing and/or identifying a protected "salmonid preserve" in the Gualala River watershed.	2	100	CDFW, NMFS, NOAA RC	
GualR-NCSW-4.1.1.2	Action Step	Landscape Patterns	Should large tracts of forestlands within the Gualala River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or protected "salmonid preserve".	2	50	CDFW, Gualala Redwood Company, NMFS, NOAA RC	
GualR-NCSW-4.2	**Objective**	**Landscape Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
GualR-NCSW-4.2.1	Recovery Action	Landscape Patterns	Prevent or minimize increased landscape disturbance				
GualR-NCSW-4.2.1.1	Action Step	Landscape Patterns	Discourage counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, Gualala Watershed Council, NMFS, North Gualala Water Company, NRCS, RCD, Sea Ranch, Sonoma County, SWRCB	
GualR-NCSW-4.2.1.2	Action Step	Landscape Patterns	Discourage any forestland to agricultural and/or rural/urban development.	2	100	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, Gualala Watershed Council, NMFS, North Gualala Water Company, NRCS, Private Landowners, Public, RCD, Sea Ranch, Sonoma County, SWRCB	
GualR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
GualR-NCSW-5.1.1.1	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at South Beach Road Crossing on Fuller Creek (Wheatfield Fork sub-basin; See CALFISH: PAD_ID 736904; Passage ID 13268)	2	10	CDFW, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD	
GualR-NCSW-5.1.1.2	Action Step	Passage	Evaluate, design, and implement appropriate fish passage designs in Palmer Canyon and McKenzie creeks (Wheatfield Fork sub-basin; Klamt et al. 2003).	2	10	CDFW, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD	
GualR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)				
GualR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Increase wood frequency in salmonid spawning and rearing areas to the extent that a minimum of 6 key LWD pieces exists every 100 meters in 0-10 meter BFW streams.	2	10	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RCD	
GualR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Design and install LWD structures in McKenzie and Wild Hog creeks, and the SF sub-basin to the extent that optimal LWD frequency is achieved at strategic locations.	2	20	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RWQCB	
GualR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 10-100 meters)				
GualR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Increase wood frequency in seasonal habitat and migratory reaches to the extent that a minimum of 1.3 to 4 key LWD pieces exists every 100 meters in 10-100 meter BFW streams.	2	10	CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD, RWQCB	
GualR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Design and implement a SF Gualala mainstem migration project. Focus should include a higher frequency of significantly large wood structures to enhance staging pool development.	2	10	CDFW, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	
GualR-NCSW-6.1.2.3	Action Step	Habitat Complexity	Evaluate, design, and implement salmonid habitat improvement structures as appropriate to the stream channel type and hydrologic conditions within the Rockpile Sub-basin	2	10	Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RCD, The Nature Conservancy	
GualR-NCSW-6.1.2.4	Action Step	Habitat Complexity	Evaluate, design, and implement salmonid habitat improvement structures as appropriate to the stream channel type and hydrologic conditions within the Buckeye Sub-basin.	2	5	CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, Private Landowners, Public, RCD, RWQCB	
GualR-NCSW-6.1.3	Recovery Action	Habitat Complexity	Improve pool shelter				
GualR-NCSW-6.1.3.1	Action Step	Habitat Complexity	Evaluate, design, and implement strategies to improve shelter pools ratings within the Rockpile and Buckeye sub-basins and the following tributaries: Boyd, Buckeye, Camper, Carson, Danfield, Doty, Dry, Franchini, Fuller, Grasshopper, Groshong Gulch, House, Little NF GR, Log Cabin, Marshall, McGann, McKenzie, NF Fuller, Lower NF GR, Palmer Canyon, Pepperwood, Rockpile, SF Fuller, Sullivan, Tombs, Wheatfield Fork, and Wild Hog creeks.	2	20	CDFW, Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD, The Nature Conservancy	This action step should be in concert with increasing LWD frequency and therefore cost could be lower.
GualR-NCSW-6.1.4	Recovery Action	Habitat Complexity	Increase primary pools frequency				
GualR-NCSW-6.1.4.1	Action Step	Habitat Complexity	Evaluate, develop, and implement strategies to increase primary pool frequency in high priority reaches within the following tributaries: Boyd, Doty, Dry, Fuller, Little NF GR, Log Cabin, Marshall, McGann, McKenzie, Palmer, Robinson, Tombs, and West Fork Fuller.	2	20	CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	
GualR-NCSW-6.1.4.2	Action Step	Habitat Complexity	Identify historic salmonid habitats lacking in channel complexity and implement restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	20	CDFW, NOAA RC, Private Landowners	
GualR-NCSW-6.1.4.3	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	20	CalFire, CDFW, NOAA RC, Private Landowners	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-6.1.4.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CDFW, NOAA RC, Private Landowners	
GualR-NCSW-6.1.4.5	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	60	CDFW, NMFS, NRCS, Private Landowners	
GualR-NCSW-6.1.5	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)				
GualR-NCSW-6.1.5.1	Action Step	Habitat Complexity	Increase the frequency of LWD to rate as Good (over 75% of IP-km within the watershed).	2	20		
GualR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GualR-NCSW-7.1.1	Recovery Action	Riparian	Improve tree diameter				
GualR-NCSW-7.1.1.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	20	Board of Forestry, CalFire, CDFW, Conservation Fund, Gualala Redwood Company, NMFS, The Nature Conservancy	
GualR-NCSW-7.1.1.2	Action Step	Riparian	Prioritize large tree retention along the SF Gualala River.	2	50	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, NMFS	
GualR-NCSW-7.1.1.3	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, NMFS, NRCS, RCD	
GualR-NCSW-7.1.2	Recovery Action	Riparian	Improve canopy cover				
GualR-NCSW-7.1.2.1	Action Step	Riparian	Increase the average stream canopy cover within potential spawning and rearing reaches to a minimum of 80%.	2	20	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, The Nature Conservancy	
GualR-NCSW-7.1.2.2	Action Step	Riparian	Evaluate buffers width and/or timber harvest in terms of light penetration and potential changes to micro-climate conditions along the SF Gualala River.	2	50	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS	
GualR-NCSW-7.1.2.3	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the NF Gualala sub-basin: upper reaches of Dry Creek, Robinson Creek, the central and higher reaches of the mainstem, and the lower reaches of Bear and Stewart Creeks (Klamt et al. 2003).	2	20	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
GualR-NCSW-7.1.2.4	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the Rockpile sub-basin: mainstem Rockpile Creek, Red Rock Creek, and Horsetheif (Klamt et al. 2003).	2	20	Board of Forestry, CalFire, CDFW, Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, RCD, The Nature Conservancy	
GualR-NCSW-7.1.2.5	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the Buckeye sub-basin: upper reaches of Buckeye Creek, Franchini, Grasshopper, and Soda Springs creeks (Klamt et al. 2003).	2	20	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
GualR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GualR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings identified in credible landowner assessments.	2	20	CDFW, NOAA RC, Private Landowners	
GualR-NCSW-8.1.1.2	Action Step	Sediment	Continue efforts such as erosion proofing, improvements, and decommissioning, through the Rockpile sub-basin to reduce sediment delivery to central Rockpile Creeks and Rockpile tributaries.	2	10	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD	
GualR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GualR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
GualR-NCSW-10.1.1.1	Action Step	Water Quality	Expand continuous temperature monitoring efforts into the upper sub-basins and tributaries that provide summer rearing for salmonids. Investigate canopy composition and monitoring air temperature to examine the relationship between canopy, temperature, and other micro-climate effects on water temperature (Klamt et al. 2003).	2	5	CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC	
GualR-NCSW-10.1.1.2	Action Step	Water Quality	Evaluate the current adequacy of buffer zones in recently logged areas and ensure stream temperatures have not increased due to these activities.	2	20	Board of Forestry, CalFire, CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, Private Landowners, RCD	
GualR-NCSW-10.1.1.3	Action Step	Water Quality	Implement actions to maintain and restore water temperatures to meet habitat requirements for steelhead in specific streams (CDFG 2004).	2	20	CDFW, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NRCS, Private Landowners	
GualR-NCSW-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)				
GualR-NCSW-12.1.1.1	Action Step	Agriculture	Discourage forest-to-vineyard land conversions or other agricultural activities that may impact natural stream channel morphology.	2	30	Board of Forestry, CalFire, CDFW, NMFS, Sonoma County	
GualR-NCSW-12.1.2	Recovery Action	Agriculture	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GualR-NCSW-12.1.2.1	Action Step	Agriculture	Assess and address sources from agricultural activities that deliver sediment and runoff to stream channels.	3	10	CA Coastal Commission, CDFW, DWR, NOAA RC, NRCS, Private Landowners, RCD	
GualR-NCSW-12.1.2.2	Action Step	Agriculture	Work with vineyard owners to assess the effectiveness of erosion control measures throughout the winter period.	3	5	CalFire, CDFW, NMFS, RWQCB, Sonoma County	
GualR-NCSW-12.1.2.3	Action Step	Agriculture	Encourage and assist the NRCS and RCD to increase the number of landowners participating in sediment reduction planning and implementation.	3	25	CDFW, NMFS, NOAA RC, Private Landowners	
GualR-NCSW-12.1.2.4	Action Step	Agriculture	Work with agencies and landowners to establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.	3	50	NRCS, Private Landowners, RCD, NOAA RC	
GualR-NCSW-12.1.3	Recovery Action	Agriculture	Prevent or minimize impairment to water quality (instream water temperature)				
GualR-NCSW-12.1.3.1	Action Step	Agriculture	Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land activities.	2	20	NOAA RC, Private Landowners, Sonoma County	
GualR-NCSW-12.1.4	Recovery Action	Agriculture	Prevent or minimize impairment to watershed hydrology				
GualR-NCSW-12.1.4.1	Action Step	Agriculture	Promote and implement off-channel storage facilities (e.g. winter diversion ponds, tanks, etc.) in efforts to reduce in-stream flow impacts associated with agricultural water use.	2	10	CalFire, CDFW, NMFS, NMFS OLE, Private Landowners, Sonoma County, SWRCB	
GualR-NCSW-12.1.5	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
GualR-NCSW-12.1.5.1	Action Step	Agriculture	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	3	20	Farm Bureau, Private Landowners, Sonoma County	
GualR-NCSW-12.1.5.2	Action Step	Agriculture	Improve education and awareness to agencies, landowners, and the general public regarding salmonid recovery and habitat requirements.	3	30	NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
GualR-NCSW-12.2.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
GualR-NCSW-12.2.1.1	Action Step	Agriculture	Coordinate with regulatory agencies authorizing/permitting forestland-to-agriculture conversions to ensure consistency with salmonid recovery goals.	2	5	CalFire, CDFW, NMFS, Sonoma County	
GualR-NCSW-12.2.1.2	Action Step	Agriculture	Streamline permit processing where landowners are conducting actions aligned with recovery priorities.	2	5	CDFW, NMFS, NOAA RC, Private Landowners, RCD	
GualR-NCSW-12.2.1.3	Action Step	Agriculture	Technical support to counties by NMFS staff should be conducted to encourage county general plan updates that include measures to conserve and protect salmonids and their habitats.	3	10	NMFS, NOAA RC, NRCS, Private Landowners, Public Works, RCD, Sonoma County	
GualR-NCSW-12.2.2	Recovery Action	Agriculture	Prevent or minimize impairment to watershed hydrology				
GualR-NCSW-12.2.2.1	Action Step	Agriculture	Identify and eliminate depletion of summer base flows from unauthorized water users.	2	20	CDFW, NMFS, NMFS OLE, NOAA RC, North Gualala Water Company, SWRCB	
GualR-NCSW-12.2.2.2	Action Step	Agriculture	Develop legislation to fund county planning for environmentally sound agricultural growth and water supply.	2	30	CDFW, NMFS, Sonoma County, SWRCB	
GualR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
GualR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
GualR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFW to modify Section California Code of Regulations, Title 14, 8.00(b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties which could stop fishing during periods of low flow. Discontinue using the Russian River at Guerneville gauging station for angling closures and use the Navarro River USGS gauging station (11468000) which better reflects hydrologic conditions in smaller unregulated coastal Sonoma/Mendocino streams.	2	100	CDFW, NMFS	
GualR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure				
GualR-NCSW-18.1.1.1	Action Step	Livestock	Work with agencies and landowners to reduce livestock and feral pig access to the riparian zone to encourage bank stabilization and re-vegetation of riparian areas within the following sub-basins: Gualala Main stem/ SF Garcia, Wheatfield Fork, Rockpile (Klamt et al. 2003).	3	20	CDFW, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD	
GualR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (quality & extent)				
GualR-NCSW-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and minimize impacts to off channel habitat, floodplains, ponds, and oxbows.	2	50	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, NMFS, NRCS, RCD	
GualR-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
GualR-NCSW-19.1.2.1	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	3	30	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, NMFS, NOAA RC, RCD	
GualR-NCSW-19.1.2.2	Action Step	Logging	Work with CalFire and others during the timber harvest permitting process to retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	2	100	Board of Forestry, CalFire, Gualala Redwood Company, NMFS, NRCS, RCD, CDFW	
GualR-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GualR-NCSW-19.1.3.1	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	60	CalFire, Private Landowners	
GualR-NCSW-19.1.3.2	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	3	20	CalFire, California Geological Survey, Private Landowners, RWQCB	
GualR-NCSW-19.1.3.3	Action Step	Logging	Establish equipment limitation zones on headwater streams and swales.	3	50	Board of Forestry, CalFire, CDFW, NMFS, NRCS, RCD	

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-19.1.3.4	Action Step	Logging	Decommissioning legacy roads, upgrading road networks, and other rehabilitation work targeting reductions in fine sediment inputs to stream networks.	2	20	Board of Forestry, CalFire, CDFW, Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, Private Landowners, RCD	
GualR-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize impairment to water quality (instream water temperature)				
GualR-NCSW-19.1.4.1	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	30	Board of Forestry, CalFire, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD	
GualR-NCSW-19.1.4.2	Action Step	Logging	Protect current riparian zones in all summer salmonid rearing areas to the extent that they are able to mature, provide, and maintain a minimum of 80% canopy cover.	2	100	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, NMFS, Private Landowners, RCD	
GualR-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
GualR-NCSW-19.1.5.1	Action Step	Logging	Work with CalFire and others through the timber harvest permitting process to conserve and manage forestlands for older forest stages.	2	100	Board of Forestry, CalFire, CDFW, Gualala Redwood Company, NMFS	
GualR-NCSW-19.1.5.2	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	60	Board of Forestry, CalFire, CDFW, NMFS	
GualR-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
GualR-NCSW-19.1.6.1	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFG Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	3	20	Board of Forestry, CDFW, NMFS	
GualR-NCSW-19.1.6.2	Action Step	Logging	Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations	2	30	CDFW, NMFS, NOAA RC	
GualR-NCSW-19.1.6.3	Action Step	Logging	Provide for properly functioning watershed processes (e.g., cycles of wood, water and sediment) by promoting long term sustainable forestry practices that support salmonid habitats.	2	100	Board of Forestry, CalFire, CDFW, NMFS, RWQCB	
GualR-NCSW-19.1.6.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	3	60	CalFire, CDFW, NMFS, Private Landowners, Sonoma County	
GualR-NCSW-19.1.6.5	Action Step	Logging	Work with state and local agencies and landowners to maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture or other land uses.	2	50	Board of Forestry, CalFire, CDFW, NMFS, County	
GualR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
GualR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
GualR-NCSW-19.2.1.1	Action Step	Logging	Work with Sonoma county planning staff to minimize rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	60	CalFire, NMFS, Sonoma County	
GualR-NCSW-19.2.1.2	Action Step	Logging	Coordinate with regulatory agencies to minimize conversions in key watersheds and discourage forestland conversions.	2	5	Board of Forestry, CalFire, CDFW, NMFS	
GualR-NCSW-19.2.1.3	Action Step	Logging	Work with CalFire and others to establish greater oversight and post-harvest monitoring by the permitting agency for operations.	2	5	Board of Forestry, CalFire, CDFW, NMFS, RWQCB	
GualR-NCSW-19.2.1.4	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	2	10	CalFire, NMFS	
GualR-NCSW-19.2.1.5	Action Step	Logging	Require tree retention on the axis of headwall swales Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	60	CalFire, California Geological Survey, CDFW, NMFS, Private Landowners, RWQCB	
GualR-NCSW-19.2.1.6	Action Step	Logging	Extend the post harvest monitoring period to a minimum of 5 years to ensure adverse effects are minimized, including THP road maintenance after harvest.	2	10	CalFire, CDFW, NMFS, Private Landowners, RWQCB	
GualR-NCSW-19.2.1.7	Action Step	Logging	Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through ESA Section 10(a)(1)(B).	3	5	Board of Forestry, CalFire, CDFW, NMFS	

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GualR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GualR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CDFW, NOAA RC, Private Landowners, RCD, Sonoma County	
GualR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	60	Private Landowners, RCD, Sonoma County	
GualR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	5	NRCS, Private Landowners, RCD	
GualR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	5	CDFW, Private Landowners, RWQCB	
GualR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Encourage, when necessary and appropriate, restricted access to unpaved roads in winter to reduce road degradation and sediment release. Where restricted access is not feasible, encourage measures such as rocking to prevent sediment from reaching streams with steelhead (CDFG 2004).	2	20	CDFW, NMFS, Private Landowners, RWQCB	
GualR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following Gualala mainstem/ SF Gualala Subbasin tributaries: McKenzie Creek, Marchall Creek, Palmer Canyon Creek, Wild Hog Creek, South Fork, and Marshall Creek.	2	20	CDFW, Gualala Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB	
GualR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following Wheatfield Fork sub-basin tributary reaches: Lower reaches of Haupt and Tabacco Creeks; Lower to middle reaches of Tombs, Wolf, and Elk creeks, and unnamed trib to the mainstem Wheatfield Fork upstream from Tombs Creek, to Elk Creek, and flanked by Bear and Gibson ridges; larger watercourses to the lower reaches of House Creek; middle to higher reaches of House, Pepperwood, Danfield, and Cedar creeks (Klamt et al. 2003).	2	20	CDFW, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GualR-NCSW-23.1.1.8	Action Step	Roads/Railroads	Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following North Fork sub-basin tributaries: Stewart, Dry, Upper Billings, upper Robinson, Doty, Log Cabin creeks, and McGann Gulch (Klamt et al. 2003).	2	20	CDFW, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GualR-NCSW-23.1.1.9	Action Step	Roads/Railroads	Use appropriately sized culverts in steep terrain to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure in the Buckeye sub-basin (GRWA 2003).	2	50	CDFW, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GualR-NCSW-23.1.1.10	Action Step	Roads/Railroads	Install locked gates at river access points to prevent 4wd vehicles from driving in the river.	2	10	CDFW, FOGualalaR, Gualala Redwood Company, Gualala Watershed Council	
GualR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
GualR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Minimize future passage barriers on newly constructed roads utilizing NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a)	2	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD, RWQCB	
GualR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Ensure that all future road or bridge repairs at stream crossing minimize impairment to fish passage for all salmonid life stages.	2	20	CDFW, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GualR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
GualR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Design new roads that avoid (to the maximum extent practicable) riparian areas and are hydrologically disconnected from the stream network.	2	60	Private Landowners, Sonoma County	
GualR-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
GualR-NCSW-23.1.4.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or steelhead watersheds.	2	10	Private Landowners, RCD	

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-23.1.4.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	5	Board of Forestry, CDFW, NMFS, NRCS, RCD, RWQCB	
GualR-NCSW-23.1.4.3	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	30	Board of Forestry, CDFW, NMFS, NOAA RC, NRCS, RCD, RWQCB	
GualR-NCSW-23.1.4.4	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	2	10	NMFS, Caltrans, County	
GualR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
GualR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (stream flow)				
GualR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Use the emergency drought operations center (EDOC) or other similar group to oversee implementation of water conservation measures and alternatives.	2	60	CDFW, CDFW Law Enforcement, NMFS OLE, North Gualala Water Company, Private Landowners, Public, Sea Ranch, Sonoma County	
GualR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Prioritize water conservation measures to maintain instream flow needs of salmonids.	3	10	CDFW, NMFS, RCD	
GualR-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
GualR-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
GualR-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB and others to ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer rearing reaches.	1	42134	CDFW, CDFW Law Enforcement, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NMFS OLE, NOAA RC, SWRCB	
GualR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Develop a stream flow model and apply it to ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	5	CDFW, CDFW Law Enforcement, NMFS, SWRCB	
GualR-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and California Water code§1707 (CDFG 2004).	2	20	CDFW, NMFS, SWRCB	
GualR-NCSW-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration				
GualR-NCSW-25.1.2.1	Action Step	Water Diversion/ Impoundment	Establish flow related adult and smolt migration thresholds for consideration in authorizing future water diversions.	1	5	CDFW, NMFS, North Gualala Water Company, SWRCB	
GualR-NCSW-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (quality and extent)				
GualR-NCSW-25.1.3.1	Action Step	Water Diversion/ Impoundment	Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months (ECORP and Kamman Hydrology & Engineering 2005).	1	5	CDFW, Gualala Watershed Council, NMFS, North Gualala Water Company, SWRCB	
GualR-NCSW-25.1.3.2	Action Step	Water Diversion/ Impoundment	Develop and implement Estuary Inflow Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.	1	5	CDFW, NMFS, SWRCB	
GualR-NCSW-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (instream temperature)				
GualR-NCSW-25.1.4.1	Action Step	Water Diversion/ Impoundment	Work with agencies and landowners to ensure future water diversions do not impair instream water temperatures during the summer and fall dry seasons.	1	10	CDFW, Gualala Watershed Council, NMFS, North Gualala Water Company, NRCS, RCD, Sea Ranch, SWRCB	

Gualala River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GualR-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
GualR-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
GualR-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	1	10	CDFW, CDFW Law Enforcement, NMFS OLE, NMFS, SWRCB	
GualR-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	20	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
GualR-NCSW-25.2.1.3	Action Step	Water Diversion/ Impoundment	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of steelhead and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	2	10	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	

Navarro River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Central Coastal
- Spawner Abundance Target: 7,800 adults
- Current Intrinsic Potential: 387.6 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

In 1965, CDFW estimated abundance of 16,000 adult winter steelhead for the Navarro River watershed (Busby *et al.* 1996). Based on the current potential habitat capacity of the Navarro River watershed, Spence *et al.* (2012) estimates a population abundance target of 7,900 adult steelhead. Few actual spawning escapement estimates exist for this population, but recent spawning surveys conducted by CDFW estimate the abundance for the 2009/10 spawning population at 102 adult fish (D. Wright, Campbell Timber, personal communication, 2010).

According to various sources, juvenile steelhead are distributed throughout much of the Navarro River basin (Entrix Inc. *et al.* 1998). Juvenile steelhead distribution data collected by CDFW was reviewed by Entrix Inc. *et al.* (1998), reporting the presence of steelhead in 33 of 35 sampled streams. Limited outmigrant monitoring on the North Fork Navarro was conducted by CDFW from 1995 to 1997 with young-of-the-year (YOY) steelhead and smolts found each year. The outmigrant sampling represents smolt production from 21 percent of the potential habitat in the Navarro River watershed. High numbers of YOY steelhead (9,015 – 60,479) were observed during these trapping efforts, and smolt numbers of 384 to 2,186 fish were also reported (KRIS Navarro website[1]).

Areas of high quality habitat exist within the North Fork Navarro subbasin, Upper Rancheria, and Indian Creek subbasins. Tributaries in these subbasins maintain suitable stream temperatures and flow, and provide the highest quality salmonid habitat in the basin (Entrix Inc. *et al.* 1998). In addition to the high quality tributary reaches, the estuary is a key habitat area that juvenile steelhead utilize for a significant part of their life history (Cannata 1998).

[1] http://krisweb.com/krisnavarro/krisdb/html/krisweb/index.htm

History of Land Use

The present-day Navarro River watershed is in multiple land use with timber harvest, agriculture (largely vineyards), and grazing as the principal uses. Historically, timber harvest was the primary land use, with harvest activities beginning in the mid-1800s and a second logging boom occurring from the 1930s to the early 1950s. Industrial and private timberlands have been harvested consistently since the 1950s, with a spike from the late 1980s to about 1998. Agricultural and grazing development began as early as the 1850s in Anderson Valley, with apple production and sheep grazing in the watershed. Italian immigrants built the first commercial winery in the valley during the early 1910s, but viticulture did not expand until the late 1970s. Current wine grape production in the Anderson Valley has increased to approximately 3,000 acres, or about 2 percent of the watershed area (NMFS GIS, CDFF FRAP GIS). The current population is approximately 3,500 people, centered largely around the town of Boonville in Anderson Valley. Highway 128 spans the length of the watershed, eventually meeting Highway 1 at the Navarro River estuary.

Past timber harvest, agricultural, and grazing impacts have resulted in the establishment of a TMDL for impaired temperature and sediment conditions by the EPA in 2000. Water diversion is an issue in this basin due to agricultural diversions; the CSWRCB (1998) concluded the Navarro should be listed as fully appropriated between April 1 and December 14. The SWRCB Division of Water Rights subsequently formally recognized the Navarro as fully allocated during the summer.

Current Resources and Land Management

The Navarro River watershed is predominately in private ownership, with forestland as the major land use (70 percent of watershed area). Rangeland makes up 25 percent of the current land use, agriculture about 2 percent, and a small percentage in rural residential development. There are also state parks, which include Hendy Woods, Paul M. Demmick, and Navarro River Redwoods State Park. The Navarro River Redwoods State Park stretches along an 11-mile corridor of the mainstem Navarro River from the North Fork to the estuary.

The Anderson Valley Land Trust, Mendocino County Water Agency, and the California State Coastal Conservancy jointly sponsored a Navarro Watershed Restoration Plan, focusing on restoration opportunities related to sediment and temperature, and their impacts on salmonid species in the watershed.

Salmonid Viability and Watershed Conditions

The following habitat indicators are rated Poor through the CAP process: LWD frequency, riparian tree diameter, shelter rating, primary pools, pool/riffle ratio for both juvenile rearing and adult salmonid lifestages. Stream temperature is also rated as Poor for juvenile summer rearing. Indicators for watershed processes that are rated as Poor through the CAP analysis include riparian species composition, road density across the watershed and within riparian areas. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes. Indicators that are rated as Fair through the CAP process, but are considered important within specific areas of the watershed include gravel quality for eggs, baseflow conditions for summer rearing and the estuary, and physical barriers for juvenile steelhead.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Navarro River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Suitable shelter ratings are required for juvenile salmonids as well as spawning adults for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. Data from CDFW habitat inventories indicate shelter ratings throughout the Navarro River watershed are poor within 90 percent of all sampled reaches. Poor to Fair LWD ratings were also documented during habitat surveys, which are due largely to a lack of functional riparian corridors and poor recruitment of large conifer species from adjacent upslope areas. The general lack of instream wood within the Navarro River watershed is from timber harvesting, and stream cleaning efforts that occurred in the 1970s through the 1980s. The multiple timber harvesting regimes since the 1850s have shifted forest size, and to some extent the composition of riparian forest from historical conifer/redwood stands characteristic of late seral forests to smaller conifer and hardwood dominated stands due to the Forest Practice Act of 1973. This shift in forest-type has resulted in lower wood volumes available for recruitment into the streams. Reduced shelter ratings across the basin reduce habitat suitability for juvenile rearing during critical low-flow summer periods and high-flow conditions in the winter.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Primary pool occurrence was suitable (40 percent by length) in only 37 percent of the streams that were habitat typed in the Navarro River watershed. Habitat complexity conditions have an overall rating of Poor for both winter and summer rearing juvenile steelhead. Most sampled streams have a high percentage of flatwater or run habitat that is less suitable for rearing lifestages of salmonids. The overall lack of pool habitat within this basin stems from increased sediment production from upslope sources (causing pool filling), and loss of LWD recruitment from past anthropogenic practices.

Water Quality: Temperature

Summer water temperatures limit steelhead habitat suitability throughout many stream reaches of the Navarro River watershed. The few remaining tributaries with cool water temperatures include several coastal tributaries that still retain a relatively good conifer/redwood-dominated riparian corridor, such as Flynn Creek and Marsh Creek. Most of the streams in the south eastern part of the watershed, such as the mainstem Navarro River, Rancheria Creek, and Indian Creek, currently have marginal to unsuitable summer stream temperatures. The University of California, Davis conducted a stream temperature study in the Navarro River watershed and concluded that juvenile steelhead sampled in lower, middle and upper Anderson Creek, lower and upper Indian Creek, and middle and upper Rancheria Creek were experiencing temperature stress (Johnson *et al.* 2002). The study showed that temperature stress by testing for heat shock proteins produced when temperature is the dominant stress (Johnson *et al.* 2002). Juvenile fish under high-stress conditions have a decreased chance of survival, and are unlikely to maintain normal growth rates required to reach a size to successfully transition to the smolt lifestage and the marine environment.

Estuary: Quality and Extent

Estuary conditions have an overall rating of Fair for summer rearing juveniles due to poor water quality when the lagoon forms during the summer months. The reduction in water quality is likely caused from reduced freshwater inflow to the estuary/lagoon in the summer and fall months. Cannata (1998) reports that maintaining adequate freshwater inflow to the lagoon is a critical component in sustaining water quality suitable for juvenile steelhead rearing within the Navarro River estuary. The USEPA (1999) reports data records from the Division of Water Rights (DWR) which show permitted summer diversions from the Navarro mainstem are approximately 9 cubic feet per second. Given the analysis of Jackson (1991) illustrating a trend of lower summer flows on the mainstem just above the estuary, it appears that water diversions occurring throughout the basin are reducing the quality of steelhead habitat in the estuary. During drier water years this impact is much more evident than in water years with greater runoff.

Riparian Vegetation: Composition, Cover & Tree Diameter

Although riparian canopy conditions are improving in areas of the watershed such as the North Fork Navarro, many streams currently have poor riparian canopy condition. Poor riparian conditions are common throughout much of the Anderson Valley and Rancheria Creek subbasins. Historical land clearing for agriculture and logging effectively removed many of the larger redwoods/conifers that shaded headwater streams throughout the basin. Much of the basin has second or third growth conifer and hardwood riparian areas that are in the process of recovery. Agriculture has removed or greatly reduced available riparian habitat by planting vineyards along many tributaries of Anderson Valley and the mainstem Navarro. Also, years of grazing activity in the southern subbasins of Anderson and Rancheria creek have reduced and impeded riparian recovery along stream channels, increasing water temperatures, reducing LWD recruitment, and ultimately reducing habitat quality.

Other Current Conditions

Flow levels in some subbasins, such as the North Fork Navarro, are not significantly impacted by water diversion at this time, and, therefore, the entire basin did not receive a Poor condition rating because water diversions impair only a portion of the available habitat. Impaired summer flow is an issue in the areas that drain from the mainstem above the North Fork Navarro (Anderson Valley). Spawning habitat quality is poor in parts of the basin due to road related sediment delivery, which is an ongoing impact in many streams, but spawning habitat quality is not rated overall as a Poor condition. In addition, many crossings associated with Highway 128 need to be assessed for steelhead migration.

Threats

The following discussion focuses on those threats that are rated as High or Very High (see Navarro River CAP Results). Recovery strategies will focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Navarro River CAP Results.

Roads and Railroads

Legacy roads from past logging and grazing activity continue to impact the Navarro River watershed. Road-related sediment yields in the Navarro River watershed account for 80 percent of the anthropogenic sediment yield in the basin (USEPA 2000). Since the late 1990s the implementation of the Navarro Restoration Plan has resulted in many road improvements to reduce sediment delivery into streams. The Resource Conservation District (RCD) and Natural Resources Conservation Service (NRCS) continue to work with private landowners to upgrade roads. The major industrial timber landowner in the watershed, MRC, has also completed some road upgrades to minimize sediment erosion into streams within subbasins located in the northern portion of the watershed. Although many roads have been upgraded, there are many existing roads that need to be decommissioned or upgraded to reduce sediment yields from potential road crossing failures, surface erosion, and road related mass wasting and gullying.

Severe Weather Patterns

The range and degree of temperature and precipitation variability is likely to increase in this watershed (Hayhoe *et al.* 2004). As a result, spawning and juvenile rearing will be impacted through larger and more frequent flood and mass wasting events, which is especially troublesome in this area due to the inherent steep terrain and unstable geology.

More frequent drought episodes impact the already stressful instream conditions that exist throughout much of the Navarro River watershed. Given that summer streamflows are already reduced by diversions, long-lasting drought patterns will likely pose a significant threat to maintaining adequate streamflows for aquatic habitat.

Water Diversion and Impoundments

The vast majority of water diversions and impoundments in this basin are associated with the relatively (1980s) recent increase in viticulture in the Anderson Valley and other non-timber areas of the basin. Agriculture is focused mainly within the southern portion of the basin, affecting the mainstem Navarro River tributaries, such as Indian, Anderson, and Rancheria creeks. Water diversions supporting viticulture, apples, and rural residential homes in these areas reduce summer baseflows, reducing available habitat and elevating instream temperatures (USEPA 2000). Many stream reaches in the Anderson Valley have reportedly gone dry with increasing frequency. As stated earlier, the Navarro River watershed has been listed as fully appropriated during the summer months. Therefore, any additional future diversions will likely be illegal if conducted in the summer months, and any additional water diversions are expected to be sought during the winter and spring months. Also, uncoordinated diversion practices designed to limit frost damage of grape crops may increase stranding potential in some tributaries.

Other Threats

In addition to the water withdrawal impacts, agriculture operations typically encroach into adjacent riparian areas, which can increase sediment delivery to the stream as well as decrease riparian shading and wood recruitment. Overgrazing has resulted in erosion and riparian impacts throughout the Navarro River watershed, especially where riparian fencing is inadequate (Entrix Inc. *et al.* 1998). Some streams have been channelized as part of agricultural or urban development (*e.g.,* Anderson Creek), but the incidence of channelization is comparatively low given the small percentage of developed land within the basin versus other more developed watersheds (*e.g.*, Russian River).

Timber harvest, sheep and cattle grazing occurs throughout the southern subbasins of Anderson and Rancheria creeks. Ongoing and future timber harvesting is expected to disturb landscape processes across the northern subbasins, but improvements are expected when the Habitat Conservation Plan (HCP) is implemented for the industrial timberlands currently managed by the Mendocino Redwood Company (MRC).

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests poor habitat conditions are limiting steelhead recovery in the Navarro River watershed. Inadequate stream shelter and pool habitat levels, largely resulting from the lack of structure formed by LWD, is evident across the basin. Although canopy cover is rated as Fair for most surveyed reaches in the watershed, stream temperatures across much of the basin remain stressful during summer months. Because impacts to baseflow during the summer from agriculture and associated water diversions do not impact salmonid habitat suitability across the basin, they are rated as Fair. Depleted baseflow and elevated stream temperature are believed to impact juvenile rearing habitat in Indian, Anderson, and Rancheria creeks. Diversions also likely degrade estuary function when the lagoon forms during the late summer and fall. Some tributaries across the basin continue to be affected by high sediment yields that affect rearing and spawning habitat.

General Recovery Strategy

Improve Canopy Cover and LWD Volume

Much of the Navarro River watershed would benefit from improved riparian composition and structure, which would increase stream shading, improve LWD recruitment, and increase instream shelter. General practices to improve riparian condition include increasing the number of riparian conservation easements, reducing timber harvest in riparian areas, increasing riparian planting, and installing livestock exclusion fencing where appropriate.

Address Upslope Sediment Sources

Roads supporting timber harvest, ranching, rural residential and agriculture, need to be upgraded to reduce fine sediment delivery into streams. High priority sites identified as major sources of sediment contribution should be the initial focus of future restoration actions. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Increase Instream Shelter Ratings and Pool Volume

Shelter ratings are Low within many (90 percent) of the surveyed stream reaches of the Navarro River watershed. Where applicable, restoration efforts should incorporate instream wood/boulder structures, and/or implement large conifer recruitment (fall trees) into degraded reaches to improve shelter and overall habitat complexity.

Address Water Diversion and Groundwater Extraction

Reduced flow conditions, and resulting disconnected flow conditions (dry stream channels), appear to be the result of water diversions and groundwater pumping, and must be minimized to protect and increase juvenile steelhead survival. Federal, state and local government, and other non-governmental organizations should work with landowners to implement creative solutions that minimize these effects; these solutions should implement conservation methods, water management planning, and water storage and recharge solutions.

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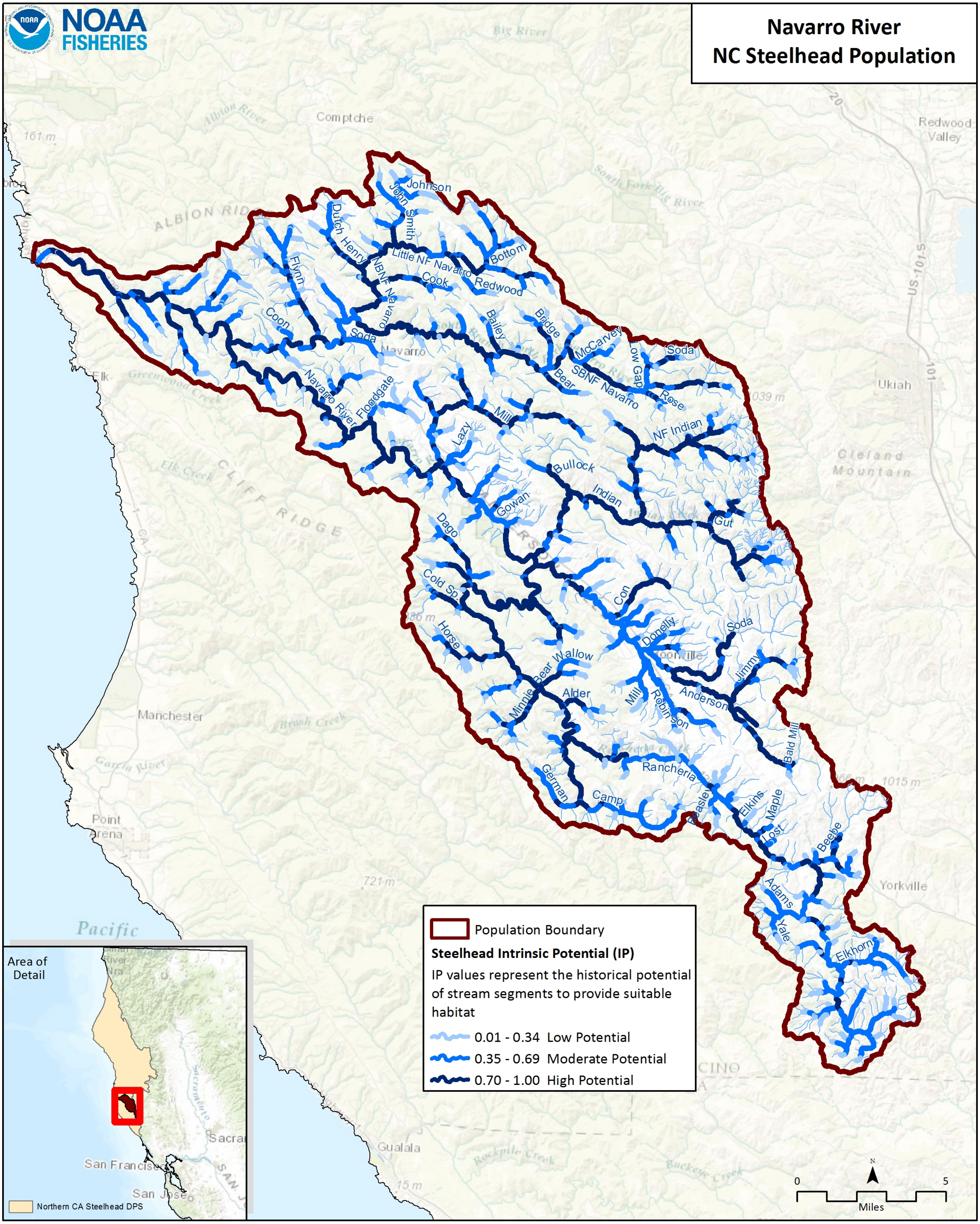
NOAA FISHERIES
Navarro River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
Miles
0
5
Comptche
Redwood Valley
Ukiah
Elk
Manchester
Point Arena
Gualala
Yorkville
Pacific

NC steelhead Navarro River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	53% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	17% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	?39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	11% of IP-km of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	21% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	16% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.59 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	?39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	21% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	16% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	?39% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.59 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		44,100-880,000 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	20-30% of Watershed in Agriculture	Fair
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	<25% Intact Historical Species Composition	Poor
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	>3 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	>1 Miles/Square Mile	Poor

NC Steelhead Navarro River CAP Threats Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Medium	Medium
2	Channel Modification	Low		Medium	Low	Low	Low	Low
3	Disease, Predation and Competition							
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Medium	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Low	Medium	Medium
9	Mining							
10	Recreational Areas and Activities							
11	Residential and Commercial Development	Low	Low	Low	Low	Low	Medium	Low
12	Roads and Railroads	Medium	Medium	Medium	Medium	Low	High	Medium
13	Severe Weather Patterns	Low	Medium	Medium	Medium	Low	High	Medium
14	Water Diversion and Impoundments	Medium	Low	High	High	Low	Medium	High

Navarro River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NvroR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
NvroR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas, and develop restoration action plans.	3	5	CDFW, County, Private Landowners	
NvroR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Evaluate Highway 128 and associated crossings with focus on the segment from the North Fork Navarro Bridge to Barton Gulch. Modify crossings based on the evaluation to provide access to historical floodplain habitats.	1	1	CalTrans, CDFW, NOAA RC	
NvroR-NCSW-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
NvroR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
NvroR-NCSW-3.1.1.1	Action Step	Hydrology	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential steelhead streams.	3	10	CDFW, SWRCB	
NvroR-NCSW-3.1.1.2	Action Step	Hydrology	Assess and map water diversions (CDFG 2004). Focus initial efforts in high priority watersheds.	2	5	Private Consultants, Private Landowners, SWRCB	
NvroR-NCSW-3.1.1.3	Action Step	Hydrology	Implement Best Management Practices (BMP's) for agriculture land use within Mendocino County (CDFG 2004).	3	100	County, CDFW	
NvroR-NCSW-3.1.1.4	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFW, Mendocino County, NMFS, NOAA RC, Private Landowners, SWRCB	
NvroR-NCSW-3.1.1.5	Action Step	Hydrology	Install streamflow gauging devices to determine the level of impairment to natural flow. Focus initial efforts on Mill Creek, Flynn Creek, and North Fork Navarro.	3	5	Private Landowners, SWRCB, USGS	
NvroR-NCSW-3.1.1.6	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses. Focus efforts along Rancheria Creek, Indian Creek, Mill Creek, and tributaries along the mainstem Navarro River above the North Fork. Tributaries such as Floodgate Creek and Perry Gulch and other small tributaries need water use evaluated.	1	5	CDFW, CDFW Law Enforcement, NMFS OLE, SWRCB	
NvroR-NCSW-3.1.1.7	Action Step	Hydrology	Work with SWRCB and landowners to purchase water rights that would improve and protect over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently or have potential to be impacted by water use.	1	20	CDFW, NOAA RC, Private Landowners, SWRCB	
NvroR-NCSW-3.1.1.8	Action Step	Hydrology	Work with SWRCB and landowners to restore and maintain the natural hydrograph between March 1 and May 15 to minimize impacts to steelhead fry due to stranding by implementing alternative frost protection strategies.	1	5	Farm Bureau, NMFS, NMFS OLE, Private Landowners	5 year period to get methods and actions in place to minimize stranding.
NvroR-NCSW-3.1.1.9	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	2	5	CDFW, NOAA RC, Private Landowners, RCD, SWRCB	Additional regulatory staff to support improved regulation of groundwater.
NvroR-NCSW-3.1.1.10	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the minimum flow needs for summer rearing for salmonids.	2	5	SWRCB	Action is considered In-Kind
NvroR-NCSW-3.1.1.11	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	20	CDFW, NOAA RC, Private Landowners, RCD, SWRCB	Number of water rights holders willing to participate is unknown at this time.
NvroR-NCSW-3.1.1.12	Action Step	Hydrology	Support a water conservation program for rural residential water users within the Navarro River watershed.	3	50	RCD, County, RWQCB	
NvroR-NCSW-3.1.1.13	Action Step	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	25	RCD, county, SWRCB, RWCQB	
NvroR-NCSW-3.1.1.14	Action Step	Hydrology	Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed managers.	3	60	CDFW, NMFS, SWRCB	
NvroR-NCSW-3.1.2	Recovery Action	Hydrology	Improve passage flows				
NvroR-NCSW-3.1.2.1	Action Step	Hydrology	Develop BMP's (such as off-channel storage) for landowners conducting water diversion actions.	2	20	NMFS, NRCS, Private Landowners, SWRCB	
NvroR-NCSW-3.1.2.2	Action Step	Hydrology	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	10	CDFW, NMFS, Private Landowners, SWRCB	
NvroR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				

Navarro River, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NvroR-NCSW-5.1.1.1	Action Step	Passage	Restore passage in high priority areas of the Navarro watershed as identified by the Mendocino RCD, MRC, the County of Mendocino, Caltrans (HWY 128), and existing fish passage databases.	1	10	RCD, CDFW, County, Private Landowners	
NvroR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
NvroR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Focus on tributaries of Flynn Creek, North Fork Navarro, South Branch Navarro, and Mill Creek.	2	10	CDFW, NOAA RC, NRCS, Private Landowners	
NvroR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	20	County, CDFW	
NvroR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004). Maintain large debris accumulations along Highway 128 on the North Fork Navarro.	2	50	CDFW, County, RCD	
NvroR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelters				
NvroR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Identify historic steelhead habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	10	CDFW, Lyme Timber, Private Landowners	
NvroR-NCSW-6.1.3	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)				
NvroR-NCSW-6.1.3.1	Action Step	Habitat Complexity	Increase the frequency of LWD to rate as Good (over 75% of IP-km within the watershed).	2	20	CDFW, NMFS, NOAA RC, Lyme Timber, Private Landowners	
NvroR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
NvroR-NCSW-7.1.1.1	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	2	5	CDFW, RCD, Private Landowners	
NvroR-NCSW-7.1.1.2	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream). Focus efforts along Anderson Creek and its tributaries, and affected areas of the Indian and Rancheria creek watersheds.	2	10	CDFW, NOAA RC, Private Landowners, RCD	
NvroR-NCSW-7.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Work cooperatively with land trusts, and Mendocino RCD to establish conservation easements, setbacks, and riparian buffers on industrial timberland, agricultural, and rangeland within high priority subbasins.	3	20	CA Coastal Commission, California Coastal Conservancy, CDFW, NOAA RC, NRCS, Private Landowners, State Parks	
NvroR-NCSW-7.1.1.4	Action Step	Riparian	Focus removal activities on existing areas of Arundo located in the upper reaches of Rancheria Creek to stop seeding and growth in downstream areas.	2	2	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
NvroR-NCSW-7.1.1.5	Action Step	Riparian	Continue removal of Arundo located in the upper reaches of Rancheria Creek to stop infestation of downstream areas.	2	10	CDFW, NOAA RC, Private Landowners, RCD	
NvroR-NCSW-7.1.1.6	Action Step	Riparian	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.	2	20	CalFire, Mendocino County, Mendocino Redwood Company, NRCS, Private Landowners, RCD	
NvroR-NCSW-7.1.1.7	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	3	20		
NvroR-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
NvroR-NCSW-7.1.2.1	Action Step	Riparian	Work with CalFire and CDFW to increase the harvest intervals to increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 trees)	2	30	CDFW, NMFS, NOAA RC, RCD, Private Landowners	
NvroR-NCSW-7.1.2.2	Action Step	Riparian	Work with CalFire and CDFW to improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other steelhead needs.	2	20	CDFW, NMFS, NOAA RC, Private Landowners, RCD	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NvroR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
NvroR-NCSW-8.1.1.1	Action Step	Sediment	Address high and medium priority sediment delivery sites as identified by the Mendocino RCD, Mendocino Redwoods Company, or other credible assessments.	2	20	CDFW, Mendocino Redwood Company, Private Landowners, RCD	
NvroR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species range or habitat**				
NvroR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
NvroR-NCSW-10.1.1.1	Action Step	Water Quality	Work with local RCD and NRCS representatives to determine stream reaches appropriate for riparian planting projects.	2	30	RCD, CDFW, County	
NvroR-NCSW-10.1.1.2	Action Step	Water Quality	Determine site-specific recommendations for improving riparian habitat to remedy high stream temperatures and implement accordingly (CDFG 2004).	2	2	CDFW, NMFS, NRCS, RCD	
NvroR-NCSW-10.1.1.3	Action Step	Water Quality	Plant native vegetation to promote streamside shade. Focus efforts in stream reaches of Indian, Anderson and the Rancheria creeks and their tributaries.	2	35	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
NvroR-NCSW-10.1.1.4	Action Step	Water Quality	Implement actions from Riparian action steps section.				
NvroR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
NvroR-NCSW-11.1.1.1	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	2	20	CDFW, NMFS, RCD, Private Landowners	
NvroR-NCSW-11.1.1.2	Action Step	Viability	Measure or estimate the condition of key habitat attributes across the watershed.	2	60	CDFW	
NvroR-NCSW-11.1.1.3	Action Step	Viability	Monitor population status for response to recovery actions.	2	20	CDFW, NMFS	
NvroR-NCSW-11.1.1.4	Action Step	Viability	Conduct monitoring activities to determine the population status of adult and smolt salmonids in major subbasins of the Navarro River.	2	60	CDFW, Mendocino Redwood Company, NOAA SWFSC, Private Landowners	
NvroR-NCSW-11.1.1.5	Action Step	Viability	Continue funding and support of the LCMS at the NF Navarro River	3	2	CDFW, Mendocino Redwood Company, NOAA SWFSC, Private Landowners	
NvroR-NCSW-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NvroR-NCSW-12.1.1.1	Action Step	Agriculture	Develop a Road Sediment Reduction Plan for agricultural lands that prioritizes problem sites and outlines implementation and a timeline of necessary actions.	2	10	Private Consultants, Private Landowners	
NvroR-NCSW-12.1.1.2	Action Step	Agriculture	Assess sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	10	Board of Forestry, CDFW, Farm Bureau, NMFS, Private Landowners	
NvroR-NCSW-12.1.1.3	Action Step	Agriculture	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	10	Farm Bureau, NMFS, Private Landowners	
NvroR-NCSW-12.1.1.4	Action Step	Agriculture	Continue implementation of the NRCS/RCD coordinated permit program for fishery restoration practices.	2	30	RCD, NMFS, CDFW	
NvroR-NCSW-12.1.1.5	Action Step	Agriculture	Work with CalFire and CDFW in the timber harvest permitting process to minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)	2	40	CDFW, Farm Bureau, NMFS, Private Landowners	
NvroR-NCSW-12.1.2	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
NvroR-NCSW-12.1.2.1	Action Step	Agriculture	Improve education and awareness of agencies, landowners and the public regarding salmonid protection and habitat requirements.	3	25	NMFS, CDFW	
NvroR-NCSW-12.1.2.2	Action Step	Agriculture	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	3	3	Farm Bureau, NRCS, RCD	
NvroR-NCSW-12.1.2.3	Action Step	Agriculture	Provide technical and staff support to counties to encourage general plan updates that include measures to protect salmonids.	3	40	County, NMFS, NOAA RC, CDFW, RCD	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NvroR-NCSW-12.1.3	Recovery Action	Agriculture	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
NvroR-NCSW-12.1.3.1	Action Step	Agriculture	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	20	CDFW, Mendocino County, NMFS, NOAA RC, NRCS, RCD	
NvroR-NCSW-12.1.4	Recovery Action	Agriculture	Prevent or minimize alterations to riparian species composition and structure				
NvroR-NCSW-12.1.4.1	Action Step	Agriculture	Maintain and enhance existing natural vegetation types within the Navarro watershed.	3	25	CDFW. RCD, County, Private Landowners	
NvroR-NCSW-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
NvroR-NCSW-12.2.1	Recovery Action	Agriculture	Prevent or minimize impairment to stream hydrology (impaired water flow)				
NvroR-NCSW-12.2.1.1	Action Step	Agriculture	Promote off-channel storage to reduce impacts of water diversion during the spring and summer (e.g. diversion during winter high flow).	2	10	CDFW, NMFS, Private Landowners, SWRCB	An analysis focusing on the amount of off-channel storage to provide improved spring and summer flows needs to be conducted prior to implementing. Participating landowners and water users could initiate prior to analysis being completed.
NvroR-NCSW-12.2.1.2	Action Step	Agriculture	Investigate the potential to provide bypass flow from agricultural storage during critical low flow period of August through October.	2	20	CDFW, NMFS, Private Landowners, SWRCB	
NvroR-NCSW-12.2.2	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
NvroR-NCSW-12.2.2.1	Action Step	Agriculture	Coordinate with the agencies to minimize conversion of range and forestland in key watersheds.	2	50	NMFS, CalFire, CDFW, RCD, County	
NvroR-NCSW-12.2.2.2	Action Step	Agriculture	The State and Mendocino County should minimize conversion of open space, rangeland, or TPZ to vineyards or other agricultural uses that impact salmonids until a grading ordinance and land conversion ordinance are in place. The ordinance should minimize runoff, erosion, sediment delivery to streams, and provide riparian protection.	2	60	Farm Bureau, County, RCD, Private Landowners	
NvroR-NCSW-12.2.2.3	Action Step	Agriculture	Implement the NRCS/RCD coordinated permit program for fishery restoration practices.	2	40	CDFW, Farm Bureau, NMFS, Private Landowners	
NvroR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
NvroR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
NvroR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	30	CDFW, NMFS, Public	
NvroR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to modify California Code of Regulations, Title 14, Section 8.00 (b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties to stop fishing during low flows. Discontinue using the Russian River at Guerneville gauging station and replace with the Navarro River USGS gauging station (11468000) to reflect hydrologic conditions for coastal streams.	2	20	CDFW, NMFS	
NvroR-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead by increasing law enforcement.	2	20	CDFW, NMFS OLE	
NvroR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification. or curtailment of the species habitat or range**				
NvroR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
NvroR-NCSW-19.1.1.1	Action Step	Logging	Should large tracts of forestlands within any essential or supporting watershed in this recovery plan become available for purchase, the Federal Government, State of California, or other entities should consider purchasing the area as a conservation area.	3		BLM, CDFW, Redwood Forest Foundation	
NvroR-NCSW-19.1.1.2	Action Step	Logging	Increase size of Navarro River Redwoods State Park if opportunities arise. At the minimum purchase or develop conservation easement on lower tributaries and associated riparian areas, including important steelhead tributaries such as Flynn Creek.	2	20	Mendocino Redwood Company, Private Landowners, State Parks	
NvroR-NCSW-19.1.1.3	Action Step	Logging	Areas adjacent to currently owned State parks or forestlands supporting essential or supporting populations should be considered for purchase (if feasible within the next 5 years).	3	30	Mendocino Redwood Company, Private Landowners, State Parks	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NvroR-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NvroR-NCSW-19.1.2.1	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	2	60	CalFire, CDFW, NMFS, Private Landowners, RWQCB	
NvroR-NCSW-19.1.2.2	Action Step	Logging	Work with CalFire through the timber harvest permitting process to identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	40	CalFire, CDFW, NRCS, Private Landowners	
NvroR-NCSW-19.1.2.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	60	CalFire, CDFW, Private Landowners, RWQCB	
NvroR-NCSW-19.1.2.4	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	60	CDFW, NMFS, Private Landowners	
NvroR-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
NvroR-NCSW-19.1.3.1	Action Step	Logging	Explore acquisition or conservation easements from willing land-owners.	3	20	CDFW, NMFS, Private Landowners	
NvroR-NCSW-19.1.3.2	Action Step	Logging	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	60	Board of Forestry, CalFire, Mendocino County, Mendocino Redwood Company, Private Landowners	
NvroR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
NvroR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
NvroR-NCSW-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews in Navarro River watershed high priority areas.	2	50	NMFS, CalFire	
NvroR-NCSW-19.2.1.2	Action Step	Logging	Work with the California Board of Forestry to design and implement a program of BMPs for logging areas that meets the approval of NMFS and CDFW.	2	3	CalFire, NMFS, NMFS OLE, Private Landowners, RWQCB	
NvroR-NCSW-19.2.1.3	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	20	CDFW, Mendocino County, NMFS, RWQCB, State Parks	
NvroR-NCSW-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	60	CalFire, Mendocino County, NMFS, Private Landowners	
NvroR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NvroR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NvroR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in areas with essential or supporting populations should be considered a high priority for funding.	2	10	CDFW, Mendocino County, Mendocino Redwood Company, NOAA RC, Private Landowners	
NvroR-NCSW-23.1.1.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction maintenance management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	10	CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, NOAA RC, NRCS, Private Landowners, Public, RCD	
NvroR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	5	CDFW, NOAA RC, Private Landowners, RCD	
NvroR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	20	CDFW, NOAA RC, Private Landowners, RCD	
NvroR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	30	CalFire, County, RCD, Private Landowners	
NvroR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	20	CalFire, County, RCD, Private Landowners	
NvroR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				

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NvroR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	60	CalFire, CDFW, Mendocino County, Private Landowners	
NvroR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	2	5	CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, NOAA RC, Private Landowners	
NvroR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
NvroR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Develop a road database using standardized methods. The methods should document all roads features, apply erosion rates, and compile information into a GIS database.	3	5	NRCS, Private Landowners, Public, RCD	
NvroR-NCSW-23.1.3.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
NvroR-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
NvroR-NCSW-23.1.4.1	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	10	CalTrans, Mendocino County Department of Public Works, NOAA RC, NRCS, Private Landowners	
NvroR-NCSW-23.1.4.2	Action Step	Roads/Railroads	Continue to refine, update, and maintain the California Fish Passage Assessment Database of barriers to fish passage.	2	10	California Coastal Conservancy, CDFW, Pacific States Marine Fisheries Commission, USFWS	
NvroR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
NvroR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
NvroR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Expand the NRCS/RCD coordinated permit program to a statewide programmatic ESA consultation that allows funding and technical expertise to small land owners and rural residential property owners.	2	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD, USACE	
NvroR-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
NvroR-NCSW-23.2.2.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a time line of necessary actions.	2	3	Mendocino Redwood Company, NRCS, Private Landowners, RCD	
NvroR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
NvroR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology				
NvroR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	2	25	NMFS, CDFW, RCD, Private Landowners	
NvroR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Conduct an analysis of critical flow levels. If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	2	60	Mendocino County, NOAA RC, Private Landowners, Public, SWRCB	
NvroR-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	2	20	NOAA RC, Private Landowners, USACE	
NvroR-NCSW-24.1.1.4	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized uses.	3	25	CDFW, NMFS, Private Landowners, SWRCB	
NvroR-NCSW-24.1.1.5	Action Step	Severe Weather Patterns	Implement mandatory water conservation measures during drought conditions to maintain viable conditions and migratory flows for adults and juveniles. Each watershed/city should have a plan that establishes drought conservation measures and circumstances for implementation.	2	100	CDFW, NMFS, Private Landowners, SWRCB, County, cities	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NvroR-NCSW-24.1.1.6	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonid recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection salmonids (Water Code § 1707).	3	40	CDFW, NMFS, SWRCB	The main benefit of this action is to improve flow conditions in stream reaches where the majority of home owners and agricultural use occurs.
NvroR-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NvroR-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	60	Board of Forestry, CalFire, CDFW, Mendocino County, Private Landowners	
NvroR-NCSW-24.1.2.2	Action Step	Severe Weather Patterns	Work with the County and other agencies to implement restrictions on new development in all historic steelhead watersheds to meet a zero net increase (or minimize the amount) in storm-water runoff, changes in duration, or magnitude of peak flow.	2	60	Board of Forestry, CalFire, CDFW, Mendocino County, Private Landowners	
NvroR-NCSW-24.1.2.3	Action Step	Severe Weather Patterns	Coordinate with county planners to minimize new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historic NC steelhead watersheds.	2	50	Board of Forestry, CalFire, CDFW, Mendocino County, Private Landowners	
NvroR-NCSW-24.1.2.4	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.	2	50	Board of Forestry, CalFire, CDFW, Mendocino County, Private Landowners	
NvroR-NCSW-24.1.2.5	Action Step	Severe Weather Patterns	See Roads actions for sediment reduction from severe winter storm events.				
NvroR-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**				
NvroR-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Improve flow conditions (instantaneous conditions)				
NvroR-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with SWRCB and landowners to restore and maintain the natural hydrograph between March 1 and May 15 to minimize impacts to steelhead fry due to stranding by implementing alternative frost protection strategies.	2	10	SWRCB, Private Landowners, County, NMFS, CDFW	
NvroR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	20	SWRCB, NMFS, CDFW	
NvroR-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	2	20	SWRCB, NMFS, CDFW	
NvroR-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Work with CDFW during the Lake and Streambed Alteration Agreement process to re-establish natural flow regimes to improve habitat suitability for salmonids.	2	30	NMFS, CDFW	

NC Steelhead DPS Rapid Assessment Profile:
Central Coastal Diversity Stratum Populations

Elk Creek

- Role within DPS: Independent Population
- Spawner Abundance Target: 205-412 adults
- Current Intrinsic Potential: 34.5 IP-km

Brush Creek

- Role within DPS: Independent Population
- Spawner Abundance Target: 126-255 adults
- Current Intrinsic Potential: 21.4 IP-km

Schooner Gulch

- Role within DPS: Dependent Population
- Spawner Abundance Target: 44-90 adults
- Current Intrinsic Potential: 7.7 IP-km

Abundance and Distribution

In these watersheds steelhead are present in variable numbers and widely distributed. The type of data and quality of data vary by watershed and by year. Aside from sporadic estimates of summer juvenile abundance, relatively little sampling has occurred in Brush Creek. Brush Creek is included in the overall suite of streams sampled in CDFW's coastal Mendocino County salmonid life cycle and regional status and trend monitoring effort but the sampling effort is part of a larger regional sampling program and estimates are, therefore, not specifically derived to estimate the greater Brush Creek steelhead population. In 2008/9, 2009/10, and 2010/11 one reach was sampled and no redds were detected and the adult population was estimated at zero (Gallagher and Wright 2012). This does not necessarily mean no adults were present, rather the surveyors failed to detect adult steelhead in the survey reaches. Past juvenile sampling has documented presence of steelhead in all years surveyed.

Neither Schooner Gulch nor Elk Creek are monitored for adult abundance but both have been sporadically surveyed for juvenile presence. In both watersheds, juvenile steelhead have been detected in the mainstem and tributaries. A barrier to steelhead migration occurs in the Elk Creek watershed and a resident trout population is present above the barrier.

History of Land Use, Land Management and Current Resources

The historic land use in the three watersheds is largely defined by timber harvest, and to a lesser degree agriculture in lower Brush Creek. Rate of timber harvest varied between the watersheds but by the 1970s most of the original forest in all three watersheds had been harvested and the forests are in their second harvest rotation.

The human population in all three watersheds is low; 27 people live in Schooner Gulch, 11 people live in the Elk Creek watershed, and 195 live in the Brush Creek watershed (NMFS 2013). Most housing is located on the marine terrace near the confluence with the Pacific Ocean, including the town of Manchester in lower Brush Creek.

Diversity Stratum Population and Habitat Conditions

The following discussion focuses on those conditions that are rated as Poor and Fair for steelhead life history stages (see "Central Coastal Diversity Stratum" Rapid Assessment). Conditions that are rated as Poor are associated with Habitat Complexity: Large Wood and Shelter. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and properly functioning watershed processes.

The majority of conditions evaluated for the three watersheds are rated as Good for most lifestages. Overall, the Brush, Elk, and Schooner watersheds are subject to fewer stressful conditions than many other watersheds in the Diversity Stratum due to a general lack of urban or rural residential impacts except in the lower portions of the watersheds.

Estuary: Quality and Extent

Estuary conditions are rated as Fair for the summer rearing lifestage, due in large part to the altered conditions associated with the stream diversion in lower Brush Creek. These diversions may lead to generally unsuitable summer rearing conditions due to poor water quality. The other two estuaries are less impacted than many other similar habitats in the DPS.

Hydrology: Baseflow and Passage Flows

Hydrology: Baseflow and Passage Flows is rated as Fair for the summer rearing and smolt lifestages, primarily due to ongoing water diversions in the lower Brush Creek watershed.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios is rated as Fair for the target lifestages, and may be limiting in select reaches in all three watersheds.

Habitat Complexity: Large Wood and Shelter

Lack of habitat complexity in the form of wood and high levels of instream sediment is rated as Fair for the adult, summer, and winter rearing lifestages. Lack of instream complexity is likely the result of long term land uses related to timber harvest in the three watersheds, particularly impacts associated with mechanized logging practices prior to the California Forest Practice Rules and removal of wood during the 1960s-1980s. Of reaches sampled in the three watersheds, data from CDFW habitat inventories indicate large wood is lacking. Threats that have caused, are causing, or may cause this condition to continue to impair steelhead life history targets include Logging, Fire and Fuel Management, and Roads/Railroads.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediment: Gravel Quality and Distribution of Spawning Gravels is rated as Poor and has had a major adverse effect on the egg lifestage, and is potentially limited for those lifestages. This factor has also been rated as Fair and has had a moderate effect on the adult and summer and winter rearing lifestages. These ratings reflect the generally high sediment loads throughout the three watersheds in particular and the Diversity Stratum in general. Threats that have caused, are causing, or may cause this condition to continue to impair steelhead life history targets include Logging, Fire and Fuel Management, and Roads/Railroads.

Viability: Density, Abundance and Spatial Structure

Viability: Density, Abundance and Spatial Structure had been rated as Fair for the target lifestages. Steelhead populations are depressed in the three watershed but all three populations maintain steelhead presence and distribution throughout the mainstems and tributaries.

Water Quality: Turbidity or Toxicity

Increased turbidity has been rated as Fair and has had a moderate effect on adults, wintering juveniles, and smolts. Sources of increased turbidity are the result of high rates of fine sediment input from upslope areas throughout the three watersheds.

Threats

The following discussion focuses on those threats that are rated as Poor and Fair (see "Central Coastal Diversity Stratum" Rapid Assessment). Recovery strategies focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in "Central Coastal Diversity Stratum" Rapid Assessment.

Agriculture

This threat is rated as Fair and is considered a moderate contribution to the condition of Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity and Estuary: Impaired Quality & Extent. The primary location where agricultural practices are considered to have an impact on gravel quality is in lower Brush Creek. A significant proportion of the marine terrace in Brush Creek is devoted to agriculture and existing buffers may not be adequate to prevent increased rates of sediment input into the lower watershed.

Fire, Fuel Management and Fire Suppression

This threat is rated as Fair and considered a moderate contributor to the condition of Habitat Complexity: Large Wood and Shelter; and Sediment: Gravel Quality and Distribution of Spawning Gravels, due to a fire reducing potential sources of future LWD recruitment and potentially increasing the rate of fine sediment input into spawning gravels following runoff in response to winter rainfall events. Increased rates of sedimentation are typical, and in combination with past and ongoing sources of sediment input, could adversely impact gravel quality and quantity necessary for successful spawning and food production. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures would likely result.

Logging and Wood Harvesting

Timber harvest is rated as Poor and remains a major contributor to two conditions for steelhead in all three watersheds, but at diminished levels compared to historical practices. It is considered a major contributor to the conditions of Habitat Complexity: Large Wood and Shelter; and Sediment: Gravel Quality and Distribution of Spawning Gravels. Even with application of new California Forest Practice Rules and the MRC HCP, this threat is anticipated to continue into the foreseeable future. Rate of timber harvest over the past 15 years is particularly high for Elk Creek (9,337 acres or 53 percent of the watershed) and Schooner Gulch (1,117 acres or 39 percent of the watershed) (NMFS 2013).

Roads and Railroads

Roads are rated as Good and a minor contributor to four conditions and rated as Fair and a moderate contributor to five others. Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in the three watersheds. Road densities are moderately high throughout the watersheds (2.0 miles/mile^2 in Brush; 2.4 miles/mile^2 in Elk; and 3.0 miles/mile^2 Schooner) and many of these roads were poorly situated and constructed[1], improperly maintained, and many have been abandoned rather than properly decommissioned.

[1] The majority of these roads were constructed prior to the passing of the California Forest Practices Rules in 1973.

Severe Weather Patterns

This threat is rated as a Good and Fair and considered a minor or moderate contributor to eleven conditions. The impacts of a severe drought (particularly in conjunction with ongoing diversions in Brush Creek) could adversely affect the summer rearing lifestage of steelhead in the watershed, and may increase the impact of the threat if water diversions increase during the summer months.

Water Diversion and Impoundments

There are relatively few diversions in Elk or Schooner but major diversions exist in lower Brush Creek. The impact of the diversions, particularly in relation to impacts to estuarine rearing is a major concern to steelhead viability in the Brush Creek watershed. CDFW stated that "(a)dditional flow diversion could substantially reduce or even eliminate flow in portions of lower Brush Creek, where critical habitat exists. CDFW initiated an instream flow study of lower Brush Creek to identify the flow conditions required to optimize and protect the stream's anadromous resources" (CDFG 2008).

Fishing and Collecting

Fishing is rated as Fair and is a considered a moderate contributor to the condition of Viability: Density, Abundance and Spatial Structure primarily due to the ambiguity of the California Freshwater Sport Fishing Regulations. The regulations imply hatchery trout and hatchery steelhead are present in Brush Creek and Elk Creek when, in reality, they are not (resident rainbow trout are present above a natural barrier in Elk Creek). Concerns were raised over potential fishing impacts from uninformed fishers who presume hatchery fish may be present in areas where they do not occur. Furthermore, the regulations authorize summer fishing with a bag limit of zero. Fish that are caught during a summer fishery are almost certainly exclusively listed steelhead and/or coho salmon juveniles which could be injured by being caught and landed and then released.

Limiting Conditions, Lifestages, and Habitats

The summer rearing and winter rearing lifestages are most limited by current conditions and future threats facing steelhead in Brush Creek, Elk Creek, and Schooner Gulch. The conditions most limiting include: Reduced LWD and Shelter. The greatest threats to recovery in these watersheds result from Logging, Severe Weather, Fire and Roads, and Fishing.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating Fair and Poor conditions and threats, as discussed above, although strategies that address other factors may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in these watersheds are discussed below with more detailed and site-specific recovery actions provided in "Central Coastal Diversity Stratum" Rapid Assessment.

Habitat Complexity: Large Wood and Shelter

Initiation of LWD enhancement efforts by the major landowners in these watersheds will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones. In addition to directly contributing to habitat complexity, LWD and other habitat features such as boulders support development of complex pools, and improve pool/riffle ratios.

Address Upslope Sediment Sources to Improve Gravel Quality and Quantity

Active and abandoned logging roads and skid trails are located throughout the three watersheds and likely contribute large volumes of sediment into the stream environment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Ongoing road work should include a component that closes and decommissions unnecessary and abandoned roads and skid trails to effectuate lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

High priority sites identified as major sources of sediment contribution should be the initial focus of future restoration actions. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Fishing

Modifications to the CDFW Freshwater fishing regulations would minimize the likelihood of impacts to adult and juvenile salmonids by fishers attempting to catch hatchery trout or steelhead. No hatchery plants have occurred in these watersheds in many years and by clarifying the fishing regulations to reflect this fact, potential impacts to the natural population can be avoided.

Ensure Protective Flows are Maintained

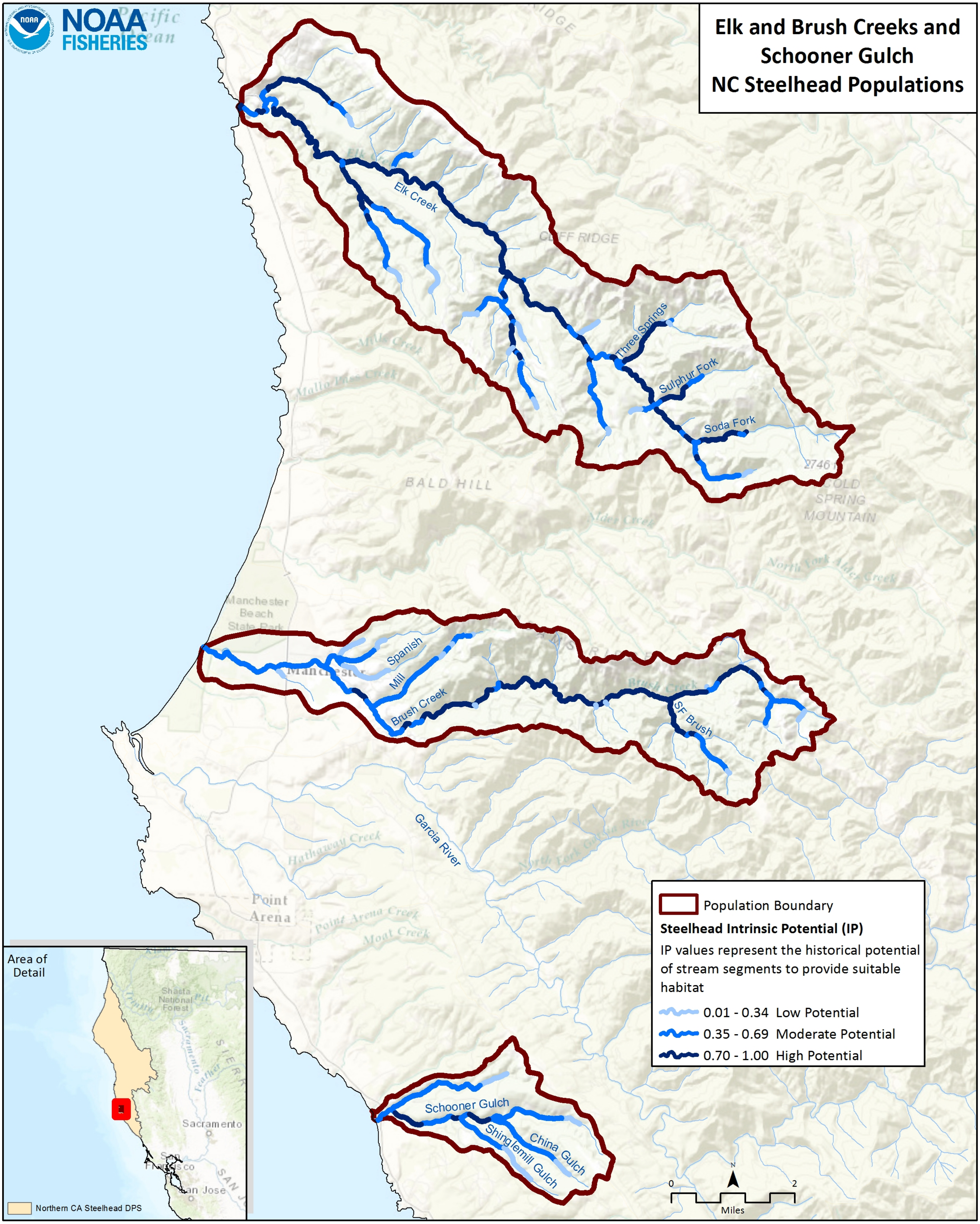
Water diversions in Brush Creek may have a major impact to steelhead juveniles rearing in the lower portion of the watershed. Adoption, implementation, compliance monitoring and enforcement of standards set forth by CDFW (CDFG 2008) would ensure flows protective of all steelhead lifestages would be met.

Literature Cited

CDFG (California Department of Fish and Game). 2008. Flow Recommendations to the State Water Resources Control Board. Prepared by the California Department of Fish and Game Water Branch.

Gallagher, S. P., and D. W. Wright. 2012. Coastal Mendocino County Salmonid Life Cycle and Regional Monitoring: Monitoring Status and Trends 2011. 2010-11 Final Report. To: California Department of Fish and Game Fisheries Restoration Grant Program Grant # P0810312 Coastal Mendocino County Salmonid Monitoring Project. California Department of Fish and Game.

NMFS (National Marine Fisheries Service). 2013. GIS database for recovery planning. Santa Rosa, California. May.


NOAA FISHERIES
Elk and Brush Creeks and Schooner Gulch NC Steelhead Populations
Elk Creek
Three Springs
Sulphur Fork
Soda Fork
CUFF RIDGE
BALD HILL
COLD SPRING MOUNTAIN
Manchester Beach State Park
Spanish
Mill
Brush Creek
SF Brush
Garcia River
Point Arena
Schooner Gulch
China Gulch
Shinglemill Gulch
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
2
Miles
Area of Detail
Sacramento
Northern CA Steelhead DPS

NC Steelhead DPS: Central Coastal Diversity Stratum (Brush/Elk/Schooner Gulch)

Habitat & Population Condition Scores By Life Stage: VG = Very Good G = Good F = Fair P = Poor		Steelhead Life History Stages				
		Adults	Eggs	Summer-Rearing Juveniles	Winter-Rearing Juveniles	Smolts
Stresses: Key Attribute: Indicators	Riparian Vegetation: Composition, Cover & Tree Diameter			G		
	Estuary: Quality & Extent	G		F	G	F
	Velocity Refuge: Floodplain Connectivity	G			G	G
	Hydrology: Redd Scour		G			
	Hydrology: Baseflow & Passage Flows	G	G	F		F
	Passage/Migration: Mouth or Confluence & Physical Barriers	G		G	G	G
	Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios	F		F	F	
	Habitat Complexity: Large Wood & Shelter	F		P	P	F
	Sediment: Gravel Quality & Distribution of Spawning Gravels	F	F	F	F	
	Viability: Density, Abundance & Spatial Structure	F		F		F
	Water Quality: Temperature			G		G
	Water Quality: Turbidity & Toxicity	F		G	F	F

NC Steelhead DPS: Central Coastal Diversity Stratum (Brush/Elk/Schooner Gulch)													
Threat Scores **L: Low** **M: Medium** **H: High**		**Stresses**											
		Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Threats - Sources of Stress	Agriculture	L	L	L	L		L	L	M	M		L	L
	Channel Modification	L	L	L	L	L	L	L	M	L		L	L
	Disease, Predation, and Competition	L	L	L			L	L	M		L	L	L
	Fire, Fuel Management, and Fire Suppression	L	L	L	L		L	L	H	M		L	M
	Livestock Farming and Ranching	L	L	L	L		L	L	L	L		L	L
	Logging and Wood Harvesting	L	L	L	L		L	M	H	M		L	M
	Mining	L	L	L	L		L	L	L	L		L	L
	Recreational Areas and Activities	L	L	L	L		L	L	M	L		L	L
	Residential and Commercial Development	L	L	L	L		L	L	M	L		L	L
	Roads and Railroads	L	L	L	L		L	L	M	M		L	M
	Severe Weather Patterns	L	L	L	L	M	L	L	M	M		L	M
	Water Diversions and Impoundments	L	H	L	L	M	L	M	M	M	M	L	L
	Fishing and Collecting										H		
	Hatcheries and Aquaculture										L	L	L

Elk Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ElkC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ElkC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase LWD, primary pools and shelters.				
ElkC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	Mendocino County, Private Landowners	
ElkC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	20	CDFW, Private Landowners	
ElkC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Allow native trees in riparian areas to age, die, and recruit into the stream naturally.	3	100	CDFW, County of Mendocino, Private Landowners	
ElkC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ElkC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
ElkC-NCSW-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	CalFire, CalTrans, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
ElkC-NCSW-8.1.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures for effectiveness at controlling erosion during the winter period.	3	100	CalFire, CDFW, NMFS, NRCS, RWQCB, USACE, USFWS	
ElkC-NCSW-8.1.1.3	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	10	CalFire, CDFW, County of Mendocino, Mendocino Redwood Company, NRCS, RWQCB	
ElkC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
ElkC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
ElkC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
ElkC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Encourage CalFire to provide plans to minimize impacts from firefighting activities to all non-County firefighters when providing firefighting assistance in the Elk Creek watershed (and all other watersheds in the County).	3	5	CalFire	
ElkC-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFW, NMFS, NRCS	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions.
ElkC-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	20	CalFire, CDFW, County of Mendocino, Santa Cruz County	
ElkC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology				
ElkC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire	
ElkC-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure				
ElkC-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	50	CalFire, CDFW, Mendocino Redwood Company, NMFS, NRCS, Santa Cruz County, USFWS	
ElkC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
ElkC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Elk Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ElkC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, Mendocino Redwood Company	This recommendation should be considered a standard practice. Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities.
ElkC-NCSW-15.2.1.2	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, Mendocino County, Mendocino Redwood Company	
ElkC-NCSW-15.2.1.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Mendocino Redwood Company	
ElkC-NCSW-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
ElkC-NCSW-15.2.2.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire, Mendocino Redwood Company	
ElkC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
ElkC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
ElkC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Improve CDFW fishing regulations to minimize incidental take of adult and juvenile steelhead.	2	2	CDFW	Fishing regulation include a summer fishery without a bag limit which could likely harm listed steelhead juveniles. References to hatchery trout (which are not planted in the watershed) should be removed from regulations so as to not inadvertently encourage fishing for a resource which is not present in the watershed.
ElkC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ElkC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
ElkC-NCSW-19.1.1.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Road surface treatment options will vary widely on road use, availability of local rock sources and geology.
ElkC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
ElkC-NCSW-19.1.2.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
ElkC-NCSW-19.1.2.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RPFs	
ElkC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Elk Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ElkC-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire, Mendocino Redwood Company	
ElkC-NCSW-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
ElkC-NCSW-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
ElkC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
ElkC-NCSW-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
ElkC-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
ElkC-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
ElkC-NCSW-19.1.5.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
ElkC-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
ElkC-NCSW-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
ElkC-NCSW-19.1.6.2	Action Step	Logging	Avoid or minimize new road construction in riparian zones	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to Class 1 streams with high IP value habitat.
ElkC-NCSW-19.1.6.3	Action Step	Logging	See Roads and Railroads for additional recommendations.				
ElkC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
ElkC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
ElkC-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, CDFW, Private Landowners, RWQCB	
ElkC-NCSW-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
ElkC-NCSW-19.2.1.3	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners, RWQCB	

Elk Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ElkC-NCSW-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
ElkC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
ElkC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
ElkC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	3	10	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
ElkC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
ElkC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	15	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
ElkC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
ElkC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	
ElkC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	30	CalFire, CalTrans, Mendocino County, Mendocino Redwood Company, RWQCB, USACE	
ElkC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
ElkC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
ElkC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in current and historical habitats.	3	100	CalFire, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners	
ElkC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, RWQCB	Some roads in the watershed are used for timber harvest and receive heightened levels of maintenance and review, as least for a short time (currently three years) following completion of a timber harvest plan. A well designed road management plan should result in overall cost savings due to reduced flood fighting actions, and stream bank and road stabilization projects.
ElkC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, CalTrans, County of Mendocino, Private Landowners, RWQCB	
ElkC-NCSW-23.2.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, Mendocino Redwood Company, Private Landowners, RWQCB	
ElkC-NCSW-23.2.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Geological Survey, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	

Elk Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
ElkC-NCSW-23.2.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	This recommendation may involve increased intra-watershed coordination among the landowners (locking and installing gates, etc.).
ElkC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**				
ElkC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
ElkC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	100	CDFW, County of Mendocino, NMFS OLE, Private Landowners	
ElkC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	100	CDFW, Private Landowners, SWRCB	

Brush Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BrC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BrC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase LWD, primary pools and shelter ratings				
BrC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	Mendocino County, Private Landowners	
BrC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	20	CDFW, Private Landowners	
BrC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Allow native trees in riparian areas to age, die, and recruit into the stream naturally.	3	100	CDFW, County of Mendocino, Private Landowners	
BrC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BrC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
BrC-NCSW-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	CalFire, CalTrans, Mendocino County Department of Public Works, Private Landowners	
BrC-NCSW-8.1.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, NMFS, NRCS, RWQCB, USACE, USFWS	
BrC-NCSW-8.1.1.3	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	30	CalFire, CDFW, County of Mendocino, NRCS, RWQCB	
BrC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
BrC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
BrC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
BrC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Encourage CalFire to provide plans to minimize impacts from firefighting activities to all non-County firefighters when providing firefighting assistance in the Elk Creek watershed (and all other watersheds in the County).	2	5	CalFire	
BrC-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions.
BrC-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	20	CalFire, CDFW, County of Mendocino	Action is considered In-Kind
BrC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology				
BrC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	2	100	CalFire	Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
BrC-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure				
BrC-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	5	CalFire, CDFW, NMFS, NRCS, USFWS	
BrC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
BrC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Brush Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BrC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire	This recommendation should be considered a standard practice. Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities.
BrC-NCSW-15.2.1.2	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire	
BrC-NCSW-15.2.1.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire	A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the altered rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures would likely result.
BrC-NCSW-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
BrC-NCSW-15.2.2.1	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	2	100	CalFire	
BrC-NCSW-15.2.2.2	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire	
BrC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
BrC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
BrC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Improve CDFW fishing regulations to minimize incidental take of adult and juvenile steelhead.	2	2	CDFW	Current fishing regulations for Brush Creek are vague and lack precision (e.g., location of Lawson bridge). Fishing regulation include a summer fishery without a bag limit which could likely harm listed steelhead juveniles. References to hatchery trout (which are not planted in the watershed) should be removed from regulations so as to not inadvertently encourage fishing for a resource which is not present in the watershed.
BrC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to Improve the low flow fishing closures.	2	5	CDFW, NMFS	
BrC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BrC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				

Brush Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BrC-NCSW-19.1.1.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Private Landowners	Road surface treatment options will vary widely on road use, availability of local rock sources and geology.
BrC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
BrC-NCSW-19.1.2.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
BrC-NCSW-19.1.2.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	CalFire, CDFW, Private Landowners, RPFs	
BrC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BrC-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire	
BrC-NCSW-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Private Landowners	
BrC-NCSW-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
BrC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
BrC-NCSW-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	3	100	CalFire, Private Landowners	
BrC-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
BrC-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Private Landowners	
BrC-NCSW-19.1.5.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
BrC-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
BrC-NCSW-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	3	100	CalFire, Private Landowners	
BrC-NCSW-19.1.6.2	Action Step	Logging	Avoid or minimize new road construction in riparian zones	3	100	CalFire, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to CFPRs Class 1 streams with high IP value habitat.
BrC-NCSW-19.1.6.3	Action Step	Logging	See Roads and Railroads for additional recommendations.				
BrC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
BrC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
BrC-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, CDFW, Private Landowners, RWQCB	

Brush Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BrC-NCSW-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	3	100	CalFire, CDFW, Private Landowners, RWQCB	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
BrC-NCSW-19.2.1.3	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners, RWQCB	
BrC-NCSW-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, County of Mendocino, Private Landowners, RWQCB	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
BrC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BrC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BrC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	3	100	CalFire, Private Landowners, RWQCB	
BrC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFW, Private Landowners, RWQCB	
BrC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	25	CalFire, Private Landowners	Primary emphasis should be placed on removing riparian roads with high sediment delivery potential adjacent to key spawning and rearing areas. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery.
BrC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
BrC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	50	CalFire, CalTrans, Private Landowners, RWQCB, USACE	
BrC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	
BrC-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
BrC-NCSW-23.1.3.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	3	100	CalFire, County of Mendocino, Private Landowners	
BrC-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
BrC-NCSW-23.1.4.1	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, CDFW, Private Landowners, RWQCB	
BrC-NCSW-23.1.4.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	3	100	CalFire, County of Mendocino, Private Landowners, RWQCB	
BrC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
BrC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Brush Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BrC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in current and historical habitats.	3	10	CalFire, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners	
BrC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, RWQCB	Some roads in the watershed are used for timber harvest and receive heightened levels of maintenance and review, as least for a short time (currently three years) following completion of a timber harvest plan. A well designed road management plan should result in overall cost savings due to reduced flood fighting actions, and stream bank and road stabilization projects.
BrC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, CalTrans, County of Mendocino, Private Landowners, RWQCB	
BrC-NCSW-23.2.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, Mendocino Redwood Company, Private Landowners, RWQCB	
BrC-NCSW-23.2.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Geological Survey, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	
BrC-NCSW-23.2.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
BrC-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BrC-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to watershed hydrology				
BrC-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB and others to ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	2	100	CDFW, Private Landowners, SWRCB	
BrC-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and California Water code §1707 (CDFG 2004).	2	20	CDFW, NMFS, SWRCB	
BrC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Promote conjunctive use of water with water projects whenever possible to maintain or restore salmonid habitat.	3	25	CDFW, NMFS, SWRCB, Trout Unlimited	
BrC-NCSW-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (quality and extent)				
BrC-NCSW-25.1.2.1	Action Step	Water Diversion/ Impoundment	Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months.	2	100	CDFW, NMFS, SWRCB	Water diversions in the lower watershed likely have significant adverse affects to estuarine water quality, particularly during late summer in dry water years.
BrC-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
BrC-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
BrC-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	100	CDFW, County of Mendocino, NMFS OLE, Private Landowners	

Brush Creek, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BrC-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	100	CDFW, Private Landowners, SWRCB	
BrC-NCSW-25.2.1.3	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	100	CDFW, Private Landowners, SWRCB	

Schooner Gulch, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SchG-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SchG-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase LWD, primary pools and shelters				
SchG-NCSW-6.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	Mendocino County, Private Landowners	
SchG-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	10	CDFW, Private Landowners	
SchG-NCSW-6.1.1.3	Action Step	Habitat Complexity	Allow native trees in riparian areas to age, die, and recruit into the stream naturally.	3	100	CDFW, County of Mendocino, Private Landowners	
SchG-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SchG-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
SchG-NCSW-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	CalFire, CalTrans, Mendocino County Department of Public Works, Private Landowners	
SchG-NCSW-8.1.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, NMFS, NRCS, RWQCB, USACE, USFWS	
SchG-NCSW-8.1.1.3	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	30	CalFire, CDFW, County of Mendocino, NRCS, RWQCB	
SchG-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
SchG-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
SchG-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, Mendocino Redwood Company	Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities.
SchG-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, Mendocino County, Mendocino Redwood Company	
SchG-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Mendocino Redwood Company	
SchG-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
SchG-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire, Mendocino Redwood Company	
SchG-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
SchG-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
SchG-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
SchG-NCSW-15.2.1.2	Action Step	Fire/Fuel Management	Encourage CalFire to provide a plan to minimize adverse effects of firefighting to all non-County firefighters when providing firefighting assistance in the Elk Creek watershed (and all other watersheds in the County).	3	5	CalFire	
SchG-NCSW-15.2.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFW, NMFS, NRCS	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions.

Schooner Gulch, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SchG-NCSW-15.2.1.4	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	20	CalFire, CDFW, County of Mendocino, Santa Cruz County	
SchG-NCSW-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology				
SchG-NCSW-15.2.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire	
SchG-NCSW-15.2.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure				
SchG-NCSW-15.2.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	5	CalFire, CDFW, Mendocino Redwood Company, NMFS, NRCS, Santa Cruz County, USFWS	
SchG-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SchG-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SchG-NCSW-19.1.1.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Road surface treatment options will vary widely on road use, availability of local rock sources and geology.
SchG-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
SchG-NCSW-19.1.2.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
SchG-NCSW-19.1.2.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RPFs	
SchG-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
SchG-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire, Mendocino Redwood Company	
SchG-NCSW-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
SchG-NCSW-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
SchG-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
SchG-NCSW-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
SchG-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
SchG-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
SchG-NCSW-19.1.5.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
SchG-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
SchG-NCSW-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	

Schooner Gulch, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SchG-NCSW-19.1.6.2	Action Step	Logging	Minimize new road construction in riparian zones	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to CFPRs Class 1 streams with high IP value habitat.
SchG-NCSW-19.1.6.3	Action Step	Logging	See Roads and Railroads for additional recommendations.				
SchG-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
SchG-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
SchG-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, CDFW, Private Landowners, RWQCB	
SchG-NCSW-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
SchG-NCSW-19.2.1.3	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners, RWQCB	
SchG-NCSW-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
SchG-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SchG-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
SchG-NCSW-23.1.1.1	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	3	10	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
SchG-NCSW-23.1.1.2	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
SchG-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	50	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
SchG-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
SchG-NCSW-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	
SchG-NCSW-23.1.2.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	5	CalFire, CalTrans, Mendocino County, Mendocino Redwood Company, RWQCB, USACE	
SchG-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
SchG-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Schooner Gulch, Northern California Steelhead (Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SchG-NCSW-23.2.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in current and historical habitats.	3	10	CalFire, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners	
SchG-NCSW-23.2.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, RWQCB	Some roads in the watershed are used for timber harvest and receive heightened levels of maintenance and review, at least for a short time (currently three years) following completion of a timber harvest plan. A well designed road management plan should result in overall cost savings due to reduced flood fighting actions, and stream bank and road stabilization projects.
SchG-NCSW-23.2.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, CalTrans, County of Mendocino, Private Landowners, RWQCB	
SchG-NCSW-23.2.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, Mendocino Redwood Company, Private Landowners, RWQCB	
SchG-NCSW-23.2.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Geological Survey, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	
SchG-NCSW-23.2.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	This recommendation may involve increased intra-watershed coordination among the landowners (locking and installing gates, etc.).
SchG-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**				
SchG-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)				
SchG-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	100	CDFW, County of Mendocino, NMFS OLE, Private Landowners	
SchG-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	100	CDFW, Private Landowners, SWRCB	