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.

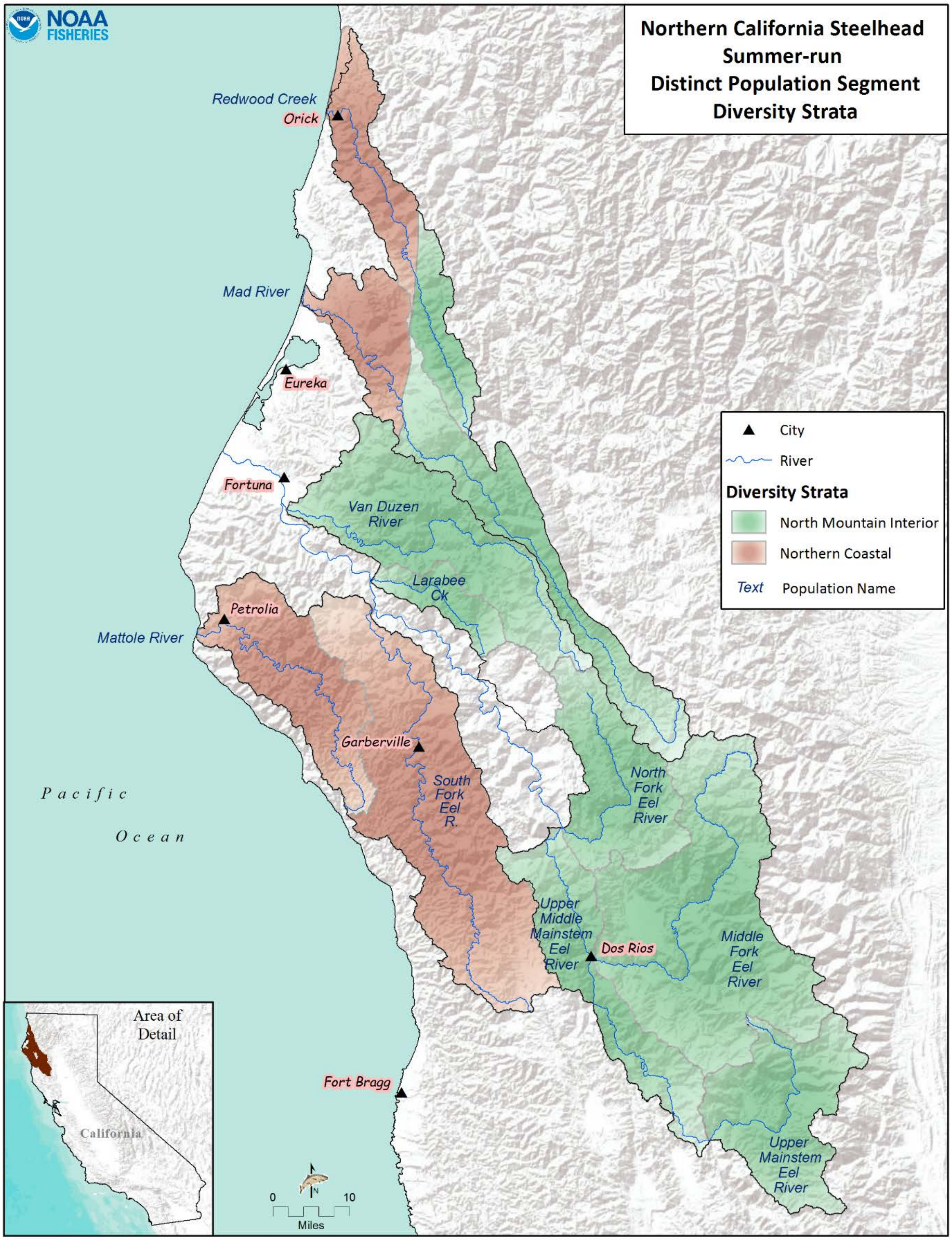
Diversity Stratum	NC steelhead Populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Northern Coastal	Bear River	I	Essential	107.8	27.2	2,900
	Big Creek	D	Supporting	3.8	6-12	21-44
	Big Flat Creek	D	Supporting	5.9	6-12	33-69
	Guthrie Creek	D	Supporting	9.2	6-12	53-108
	Howe Creek	D	Supporting	13.9	6-12	81-165
	Humboldt Bay Tributaries	I	Essential	212.1	20.0	4,200
	Jackass Creek	D	Supporting	7.6	6-12	44-89
	Little River (Humboldt Co.)	I	Essential	50.0	35.3	1,800
	Lower Mainstem Eel River Tributaries	D	Supporting	166.9	6-12	999-2,001
	Mad River (Lower)*	I	Essential	148.3	21.6	3,200
	Maple Creek/Big Lagoon	I	Essential	71.7	32.3	2,300
	Mattole River	I	Essential	541.1	20.0	10,800

	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	183.7	20.0	3,700
	Shipman Creek	D	Supporting	2.3	6-12	12-26
	South Fork Eel River	I	Essential	986.8	20.0	19,700
	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					**37,800**

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/).

Steelhead 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; HRC 2013). Following the 2007 replacement of a culvert road crossing with a bridge in the Happy Valley area, barriers to fish passage on 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. 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 Humboldt Redwood Company (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 predominately rangeland and is grazed primarily 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 gully erosion and stream bank stabilization.

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 primarily 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 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.

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 denude 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).

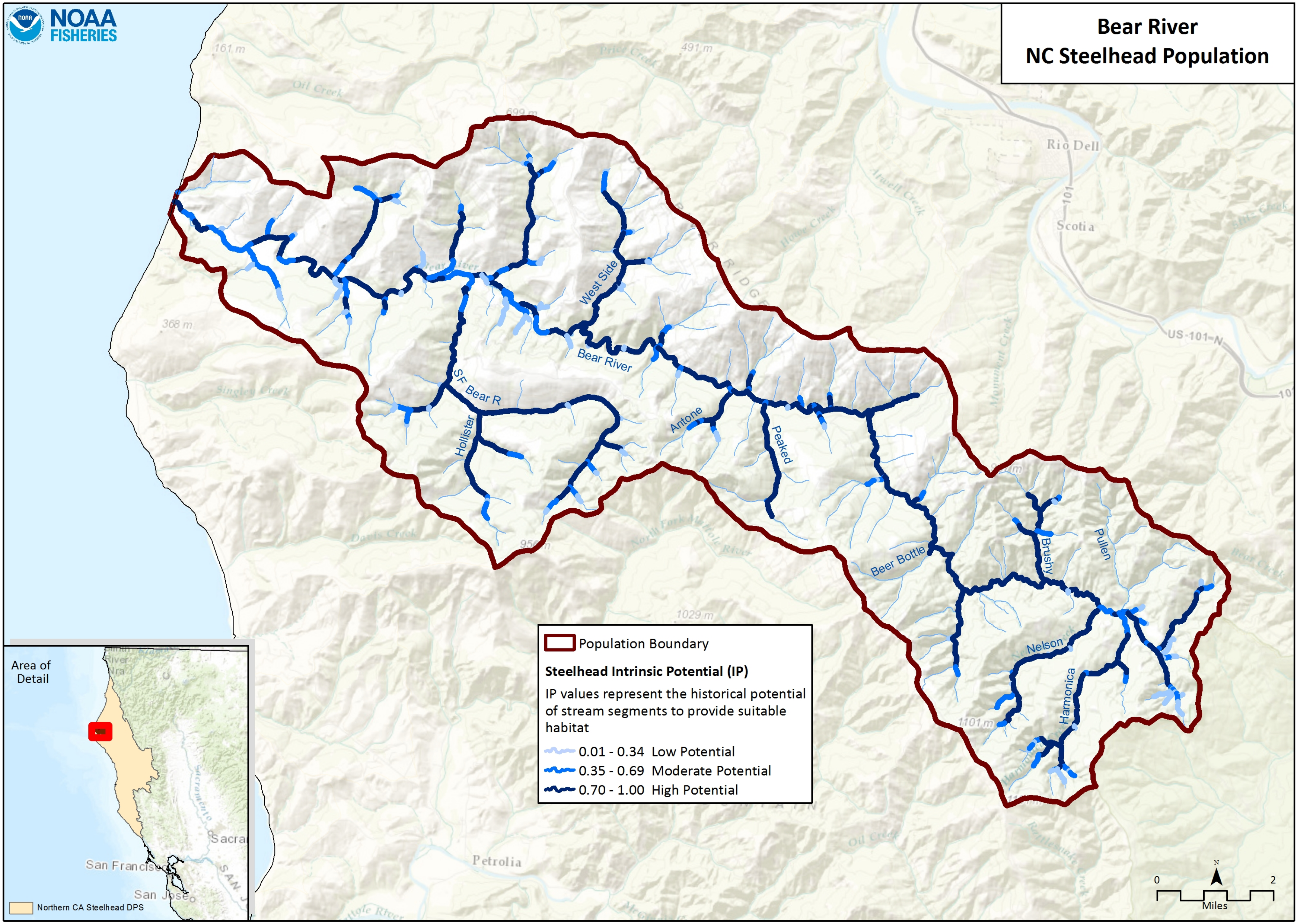
Improve Estuary Habitat

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

Literature Cited

Humboldt Redwood Company. 2008. Bear River Watershed Analysis, Cumulative Watershed Effects. Public Review Draft. December 2008. Humboldt Redwood Company LLC.

Pacific Lumber Company. 1999. Habitat conservation plan for the properties of the Pacific Lumber Company, Scotia Pacific Holding Company, and Salmon Creek Corporation.



NOAA FISHERIES
Bear River
NC Steelhead Population
Rio Dell
Scotia
US-101-N
West Side
Bear River
SF Bear R
Hollister
Antone
Peaked
Beer Bottle
Brushy
Pullen
Nelson
Harmonica
Petrolia
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
2
Miles
N

	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; >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)	<50% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)	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; <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)	27.27 IP-km (<20 C MWMT; <16 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
			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)		
			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		
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

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	Hatcheries and Aquaculture	Medium	Low	Medium	Low	Medium	Low	Medium
5	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Low	Medium
6	Fishing and Collecting	Medium	Low	Medium	Low	Medium	Low	Medium
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
	Threat Status for Targets and Project	High	High	Very High	High	High	Medium	Very High

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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.	2	10	CDFW						0	Cost accounted for in Monitoring Chapter
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										Focus on High IP subwatersheds
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	115.00					115	Cost for fish/habitat restoration assessment at a rate of $114,861/project.
BearR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Place instream structures, guided by assessment results.	3	10	CDFW, NMFS, NOAA RC, Private Landowners, RCD						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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-6.1.1.2	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						0	Action is considered In-Kind
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, Private Consultants	115					115	Cost for fish/habitat restoration assessment at a rate of $114,861/project.
BearR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Place instream structures, guided by assessment results.	3	20	CDFW, Humboldt Redwood Company, NMFS						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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						0	Action is considered In-Kind
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										Focus on High IP subwatersheds

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
BearR-NCSW-7.1.1.2	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	100	Humboldt Redwood Company						0	Action is considered In-Kind
BearR-NCSW-7.1.1.3	Action Step	Riparian	Plant native vegetation to promote streamside shade.	1	20	CDFW, Humboldt Redwood Company, NMFS, NOAA RC, Private Landowners, RCD						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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										
BearR-NCSW-8.1.1.1	Action Step	Sediment	Inventory sediment sources, and prioritize for treatment.	3	5	Humboldt Redwood Company, Private Landowners, RCD						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						~~0~~	Cost accounted for in Monitoring Chapter
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						0	Action is considered In-Kind
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.	2	5	CDFW, NMFS						0	Action is considered In-Kind
BearR-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Determine impacts of scientific collection on salmonids in terms of VSP parameters and incorporate delisting criteria when formulating scientific collection authorizations.	3	5	CDFW, NMFS						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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)										Focus on High IP subwatersheds

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
BearR-NCSW-18.1.1.1	Action Step	Livestock	Assess grazing impact on sediment delivery and identify opportunities for improvement.	3	15	Private Consultants, Private Landowners, RCD						0	Action is considered In-Kind
BearR-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										Focus on High IP subwatersheds
BearR-NCSW-18.1.2.1	Action Step	Livestock	Plant vegetation to stabilize streambank.	3	20	CDFW, NRCS, Private Consultants, Private Landowners, RCD						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
BearR-NCSW-18.1.2.2	Action Step	Livestock	Fence livestock out of riparian zones.	2	25	Private Consultants, Private Landowners, RCD						TBD	TBD, based on amount of linear feet of fencing to exclude livestock from riparian zones. Cost estimated at a rate of $3.63/ft.
BearR-NCSW-18.1.3	Recovery Action	Livestock	Prevent or minimize impairment to water quality (e.g. turbidity, suspended sediment)										Focus on High IP subwatersheds
BearR-NCSW-18.1.3.1	Action Step	Livestock	Remove instream livestock watering sources.	3	25	NRCS, Private Consultants, Private Landowners, RCD						TBD	TBD, based on number of livestock watering sources and feasible alternatives. Cost estimated at a rate of $858/tank with a 500 ft of piping at a rate of $0.84/ft.
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)										Focus on High IP subwatersheds
BearR-NCSW-18.2.1.1	Action Step	Livestock	Develop grazing management plan to meet objective.	3	10							0	Action is considered In-Kind
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						0	Action is considered In-Kind
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.).	2	50	Humboldt Redwood Company						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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.	2	50	Humboldt Redwood Company						0	Action is considered In-Kind
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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	79.00					79	Cost based on road inventory for 82 miles of road at a rate of $957/mile.
BearR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	20	Humboldt Redwood Company, Private Landowners, RCD						TBD	TBD, based on amount of road network to decommission. Cost estimated at a rate of $12,000/mile.
BearR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	15	Humboldt Redwood Company, Private Landowners, RCD						TBD	TBD, cost based on amount of road network to upgrade. Cost estimated at a rate of $21,000/mile.
BearR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	20	Humboldt Redwood Company, Private Landowners						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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 Consultants, Private Landowners						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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)										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						TBD	Cost for this action step cannot be determined without developing a hydrologic model. Cost estimated for a hydrologic model estimated at $65,084/project.
BearR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Reduce diversions.	2	25	Private Landowners, RCD						TBD	Cost based on amount of diversions in watershed. Reduction in diversions could result in a reduction in the number of diversions, the volume of the diversion, and/or the frequency of diversion; with cost associated with each action.
BearR-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Provide education and training on conserving water while diverting.	2	20	Private Landowners, RCD						0	Action is considered In-Kind
BearR-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Provide incentives to landowners to reduce water consumption during low flow periods.	2	20	Private Landowners, RCD						TBD	Cost are highly variable depending upon current market value, landowner participation, and feasibility of program.

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/).

Steelhead 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 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 tan oak 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 instreams. 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 Green Diamond Resource Company (Jacoby Creek, Freshwater Creek, Salmon Creek). Approximately 78 percent of the Freshwater Creek (30.7 mi^2) and Ryan Slough (14.7 mi^2) watersheds are managed by these two companies for commercial timber harvest (Pacific Watershed Associates 2006). 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 include: 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 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 ac 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, maintaining instream flows and enhancing riparian habitat, and 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) (2005);
- North Coast Anadromous Salmonid Conservation Assessment (Tussing and Wingo-Tussing 2005);
- Humboldt Bay Ecosystem-Based Management Program (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, 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.

Population and Habitat Stresses

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. 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, reductions 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; thereby, increasing the probability of redd scour, 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. Poor landing and stream crossing locations, and road construction practices (from the 1930s to the early 1970s) experienced very large stressing storms in the late 1990s following a high level of logging operations. 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.

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 (EPA), under the Clean Water Act Section 303(d), as sediment impaired. 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.

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. 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 rearing juveniles and smolts. Juvenile steelhead use estuarine habitat for rearing, as a transitional habitat between the freshwater and marine environments, and 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 (2013) reported 80-90% of large steelhead smolts in 2007-2008 originated from the stream-estuary ecotone habitat in Freshwater Creek.

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.

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.

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

Habitat Complexity, percent primary/staging pools and pool/riffle/flatwater ratio has an overall rating of Fair for winter-run adults and summer-rearing juveniles. See previous 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

Redd Scour has a Fair rating for eggs based on the high road density and increased peak runoff events.

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.

Hydrology: Baseflow and Passage Flows

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

<u>Very Good to Good Current Conditions</u>

Hydrology: Impervious Surfaces

Hydrology: Impervious surfaces has a rating of Very Good.

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.

Population and Habitat Threats

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 (PWA 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.

Residential and Commercial Development

Overall, this threat rates as Medium. The Humboldt Bay Management Plan (HBHRCD 2007) identified the primary use in Humboldt Bay, in the area below the Samoa Bridge to South Bay (which serves as a salmon migratory corridor and rearing habitat), for port related activities. 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 2005a), and the volume of discharge would increase with fully realized potential of the land zoned for residential development.

Disease, Predation and Competition

Overall, this threat rates as Medium. Non-native species pose a Medium threat to juveniles and smolts both in freshwater and in tidally influenced habitat in the 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

Overall, this threat is Medium. 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 (2009). 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.

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

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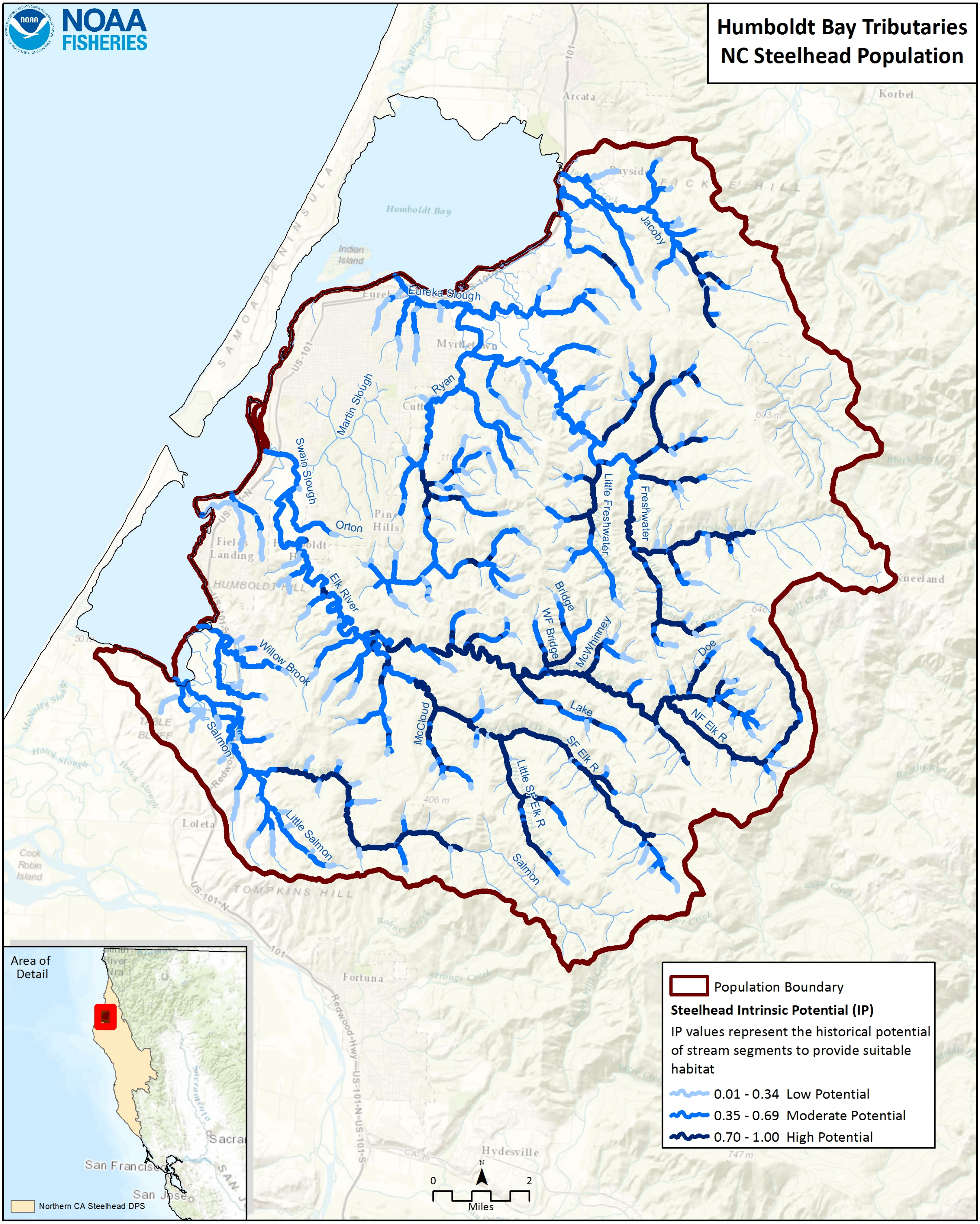

NOAA FISHERIES
Humboldt Bay Tributaries
NC Steelhead Population
Humboldt Bay
Eureka Slough
Jacoby
Ryan
Martin Slough
Swain Slough
Orton
Little Freshwater
Freshwater
Elk River
Bridge
WF Bridge
McWhinney
Doe
Willow Brook
Lake
NF Elk R
Salmon
McCloud
SF Elk R
Little SF Elk R
Little Salmon
Arcata
Korbel
Kneeland
Fortuna
Hydesville
Loleta
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
Northern CA Steelhead DPS

#	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)	N/A	
			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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	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	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)	N/A	
			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; >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)	98% of streams/ 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	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; <18.1 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	98.93% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	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)	N/A	
			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	50% to 74% of streams/ IP-Km	75% to 90% of streams/ IP-Km	>90% of streams/ IP-Km		

					(>80 stream average)	(>80 stream average)	(>80 stream average)	(>80 stream average)		
			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		
		Size	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
		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

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	32.3	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	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

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	Hatcheries and Aquaculture	Low				Low		Low
5	Fire, Fuel Management and Fire Suppression			Medium	Low	Medium		Medium
6	Fishing and Collecting	Low						Low
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
	Threat Status for Targets and Project	Medium	Medium	High	High	High	High	High

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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.	2	25	CDFW, NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
HumbB-NCSW-1.1.1.2	Action Step	Estuary	Increase connectivity and salmonid access to watersheds entering Humboldt Bay.	2	25	CDFW, NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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	57.50	57.50				115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
HumbB-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Create habitat guided by plan.	2	20	NGO						TBD	Cost will vary depending on the outcomes of the plan.
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		CDFW	115					115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
HumbB-NCSW-6.1.1.2	Action Step	Habitat Complexity	Increase LWD, boulders, or other instream structure, guided by assessment.	2		NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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		NGO						TBD	
HumbB-NCSW-7.1.1.2	Action Step	Riparian	Remove non-native species that inhibit establishment of native riparian vegetation	2		NGO						TBD	
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)										
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		NGO						TBD	Cost will depend on extent and methods of the study, and on the measures needed.
HumbB-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
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.	2	15	NRCS, RCD						~~0~~	Cost likely accounted for in above action step for fish/habitat restoration assessment.
HumbB-NCSW-18.1.1.2	Action Step	Livestock	Develop grazing management plan to reduce impacts of grazing on riparian and instream habitat.	2	10	NRCS, RCD						0	Action is considered In-Kind
HumbB-NCSW-18.1.1.3	Action Step	Livestock	Fence livestock out of riparian zones.	2	20	Private						TBD	Cost based on the amount of linear feet to fence. Cost estimated at a rate of $3.63/ft.
HumbB-NCSW-18.1.1.4	Action Step	Livestock	Plant vegetation to stabilize stream bank.	2	20	NGO						TBD	Cost will vary with assessment methods and level of detail.
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						0	Action is considered In-Kind
HumbB-NCSW-19.1.1.2	Action Step	Logging	Plant conifers as guided by prescription	1	25	NGO						TBD	Cost will be based on amount of acres to be planted. Estimate for riparian planting is $20,719/acre.
HumbB-NCSW-19.1.1.3	Action Step	Logging	Thin, or release conifers guided by prescription	2	20	Private						TBD	Cost will be based on amount of acres to be treated identified in plan. Estimate for conifer release is $1,468/acre.
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.	1	10	CalFire						0	Action is considered In-Kind
HumbB-NCSW-19.2.1.2	Action Step	Logging	Apply BMPs for timber harvest.	1	50	Private						0	This should be considered standard practice. Action is considered In-Kind
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	1	20	NGO						~~TBD~~	Cost will be based on amount of road network. Estimate was not able to be made because there is no estimate of roads for the tributary streams to Humboldt Bay.
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						0	Cost accounted for in above action step.
HumbB-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission roads, guided by assessment	1	10	NGO						TBD	Cost based on number of miles of road network identified to be decommissioned from assessment. Estimate for road decommissioning is $12,000/mile.

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
HumbB-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment	2	25	Private						0	Action is considered In-Kind
HumbB-NCSW-23.1.1.5	Action Step	Roads/Railroads	Upgrade roads, guided by assessment	2	20	Private						TBD	Cost based on number of miles of road network needed to be upgraded identified by assessment. Estimate for road upgrade is $21,000/mile.

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/).

Steelhead Abundance and Distribution

Since 1998, outmigrant trapping, summer juvenile, and adult spawning 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 (Shaw and Jackson, 1994; Vogel 1992; 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-May, peaking in late April. Juvenile steelhead population estimates between 1998-2010 ranged 222-719 individuals (GDRC 2009)(Figure 1).

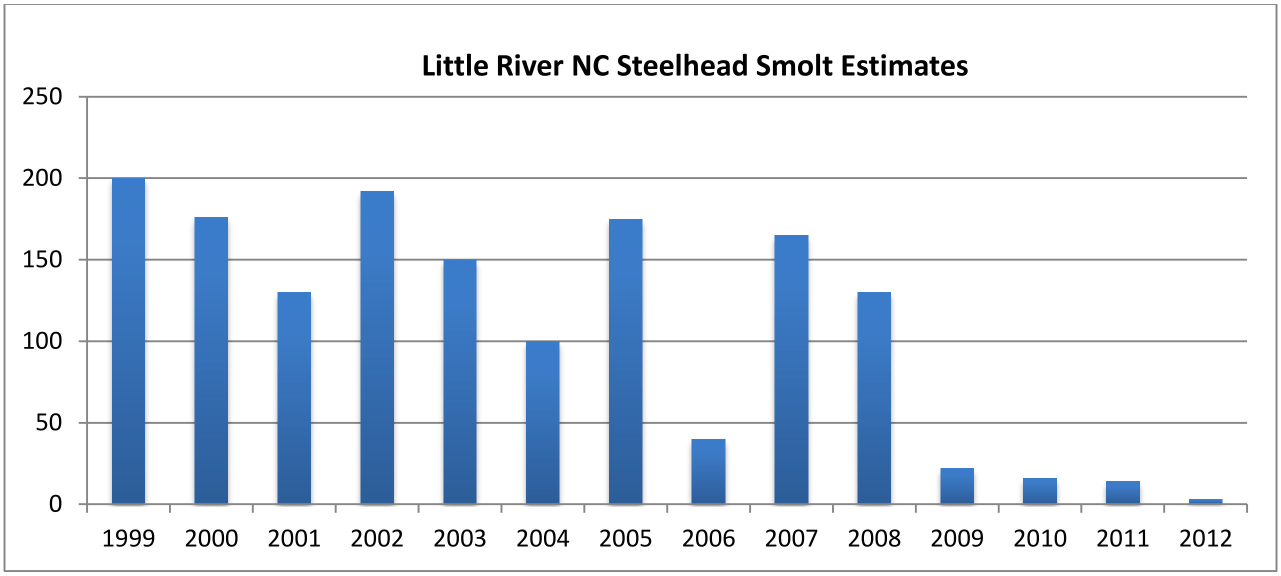

Figure 1. Out-migrant NC steelhead population estimates from Little River tributaries, 1998-2010 (GDRC 2009, 2011).

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), pool/riffle/flatwater ratio, 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 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.

Population and Habitat 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 (Moseley *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, LP 1994). Green Diamond completed large wood surveys for the Little River Basin in 2009; 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

A population with diverse genetics and behaviors exhibits variation in life history parameters such as age at smolting, age at maturity, spawning time, and fecundity. If a population is genetically diverse, it is more likely to be resilient to variation in environmental habitat fluctuations such as productivity, spawning run timing, and egg incubation time. 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.

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

Complex pools provide rearing habitat for juvenile steelhead. Reduced pool complexity results in decreased vegetative cover and prey availability, and thus juvenile growth rates. Historical logging process resulted in large sediment input into Little River, resulting in pool aggradation. Less than half of the watershed contains greater than 30 percent pool habitat (Vogel 1992), which is stressful for winter and summer rearing juveniles.

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 McDonald 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 Hartman 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 instream 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 young to mature deciduous and conifers dominate the upper watershed and dense shrubs such as willow and blackberry occupy the lower watershed (GDRC 2006, Vogel 1992). 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

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 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. 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.

Very Good or Good Rated Current Conditions

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.*, in press). Floodplain in lower Little River has been decreased by channel modification, historic timber operations, and the construction of levees for agricultural purposes. All life history phases of are exposed to decreased availability of floodplain habitat, and thus rich foraging areas are unavailable. 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, severely affecting 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 may improve habitat conditions and population abundance.

Roads and Railroads

Roads and railroads were rated as a High stress for steelhead winter adults, eggs, winter rearing juveniles, smolts, and watershed processes. 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 (landslide scars exposed to rain splash), and gullying. Existing road networks are a chronic source of sediment to streams (Swanson 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, 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 Little River. In order to reduce this threat, 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 threats and stress analysis within the CAP workbook process suggest steelhead eggs, summer and winter rearing juveniles, smolts, and water processes are all potentially limiting population abundance and diversity in Little River. 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 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 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 roads contributes to poor salmonid habitat conditions including elevated turbidity levels, stream aggredgation, and impaired gravel quality. Existing road-stream connections should be assessed and upgraded or decommissioned to the maximum extent practical.

Stream Restoration

Little River currently lacks habitat complexity in many areas due to reduced large woody debris, channel aggredgation, 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.

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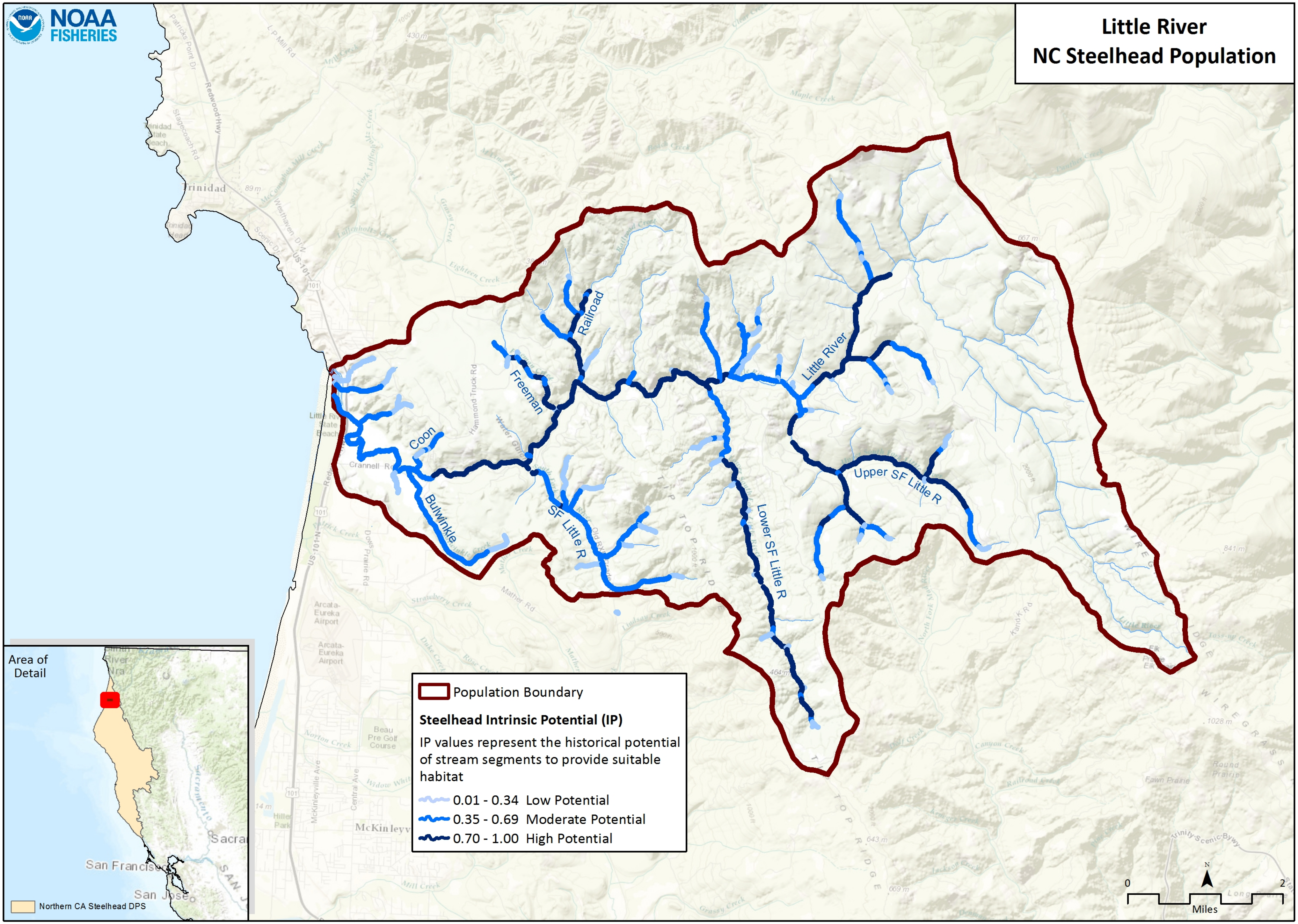
Little River
NC Steelhead Population
NOAA FISHERIES
Railroad
Freeman
Coon
Bulwinkle
SF Little R
Lower SF Little R
Little River
Upper SF Little R
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34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

#	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)	<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)	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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	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 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; >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)	85% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	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; <18.1 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	100% IP-km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	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	<0.2 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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	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	50% to 74% of streams/ IP-Km	75% to 90% of streams/ IP-Km	>90% of streams/ IP-Km		

					(>80 stream average)	(>80 stream average)	(>80 stream average)	(>80 stream average)		
			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		
		Size	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
		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

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	25-30	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	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

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	Hatcheries and Aquaculture							
5	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
6	Fishing and Collecting	Low						Low
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
	Threat Status for Targets and Project	Medium	High	High	High	High	High	High

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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.	1	1	CDFW, Coastal Conservancy, NMFS	34.11					34	
LTRNC-NCSW-1.1.1.2	Action Step	Estuary	Restore tidal wetlands and tidal channels, guided by plan.	1	5	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
LTRNC-NCSW-1.1.1.3	Action Step	Estuary	Assess and prioritize tidegates and levees for removal or replacement.	1	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	34.11					34	
LTRNC-NCSW-1.1.1.4	Action Step	Estuary	Remove or replace tidegates and levees, guided by assessment.	1	5	CDFW						TBD	Cost based on number of tidegates to be removed.
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.	3	1	CDFW						TBD	
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-6.1.1.2	Action Step	Habitat Complexity	Develop plan to restore habitat complexity by recreating off-channel ponds, alcoves, and backwater habitat.	2	1	CDFW, Coastal Conservancy, NMFS	1,335					1,335	
LTRNC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Restore habitat complexity in identified areas by implementing actions to increase the frequency of pool habitats.	2	10	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
LTRNC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency										
LTRNC-NCSW-6.1.2.2	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	1,335					1,335	
LTRNC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Place instream structures, guided by assessment.	2	5	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
LTRNC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
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 capturing the majority of fine sediments before entering watershed.	2	1	CDFW, Coastal Conservancy, NMFS, Private Landowners						~~0~~	Cost accounted for in Monitoring Chapter
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	115					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
LTRNC-NCSW-8.1.1.3	Action Step	Sediment	Plant riparian species to augment riparian vegetation.	3	3	CDFW, Coastal Conservancy, NMFS, Private Landowners						0	Cost accounted for in above action step.
LTRNC-NCSW-8.1.1.4	Action Step	Sediment	Assess potentially large inputs of fine sediments (e.g., landslides, failed culvert).	2	1	CDFW, Coastal Conservancy, NMFS, Private Landowners	91.00					91	Cost based on erosion assessment for 25% of total watershed acres at a rate of $12.62/acre.
LTRNC-NCSW-8.1.1.5	Action Step	Sediment	Develop plan to remove large inputs of fine sediments.	2	1	CDFW, Coastal Conservancy, NMFS, Private Landowners						TBD	
LTRNC-NCSW-8.1.1.6	Action Step	Sediment	Remove large inputs of fine sediments.	3	10	CDFW, Coastal Conservancy, NMFS, Private Landowners						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
LTRNC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LTRNC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
LTRNC-NCSW-19.1.1.1	Action Step	Logging	Increase conifer density and diameter at breast height by determining appropriate silvicultural prescription for benefits to listed salmonids.	2	1	CDFW, CalFire, NMFS, Private Landowners						0	Action is considered In-Kind
LTRNC-NCSW-19.1.1.2	Action Step	Logging	Plant conifers, guided by prescription.	2	2	CDFW, CalFire, NMFS, Private Landowners						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
LTRNC-NCSW-19.1.1.3	Action Step	Logging	Thin, or release conifers, guided by prescription.	2	5	CDFW, CalFire, NMFS, Private Landowners						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
LTRNC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
LTRNC-NCSW-19.1.2.1	Action Step	Logging	Identify and prioritize existing roads that are no longer necessary for silvicultural operations.	2	1	CDFW, CalFire, NMFS, Private Landowners	791					791	
LTRNC-NCSW-19.1.2.2	Action Step	Logging	Develop plan to decommission roads.	2	1	CDFW, CalFire, NMFS, Private Landowners						0	Cost accounted for in above action step.
LTRNC-NCSW-19.1.2.3	Action Step	Logging	Decommission roads throughout watershed.	2	10	CDFW, CalFire, NMFS, Private Landowners						TBD	Cost based on number of miles of road network identified to be decommissioned from assessment. Estimate for road decommissioning is $12,000/mile.
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.)										

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LTRNC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess streamside roads and prioritize decommissioning to minimize mass wasting.	3	1	CDFW, CalFire, NMFS, Private Landowners						~~0~~	Cost accounted for in above action step.
LTRNC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Develop plan to decommission or maintain roads.	3	1	CDFW, CalFire, NMFS, Private Landowners						~~0~~	Cost accounted for in above actions step.
LTRNC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission or upgrade roads throughout watershed.	3	20	CDFW, CalFire, NMFS, Private Landowners						~~0~~	Cost accounted for in above action step.

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: 6,100 adults
- Current Intrinsic Potential: 303.8 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/).

Steelhead 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 Chinook salmon, coho salmon, and 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 (2002a) 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 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/rifle/flatwater ratio, road density, shelter, and turbidity. Other indicators that are identified as impaired include the following: LWD frequency, water temperature (NC steelhead), 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.

Population and Habitat 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 (Halligan, Stillwater Sciences, personal communication, 2011). Excess sediment in the Mad River affects all lifestages 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 conditions have 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, rip rap, 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 instreams 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 *Steelhead 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 lifestage. 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.

Population and Habitat Threats

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 lifestages, 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. The current mining is permitted by the Army Corps of Engineers and the permit contains numerous minimization measures to reduce the effects of gravel extraction on fish habitat, such as a head-of-bar buffer to provide for channel steering around 10 skimmed gravel bars, provisions to provide low to moderate flow channel confinement, mining volumes that are scaled to annual water yield) and annual estimates of sediment recruitment to the lower Mad River. However, even with minimization measures, gravel extraction 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; 15 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 lifestages of winter-run and summer-run steelhead. Sparkman (2002a) 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 (CDFW unpublished data). 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 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.

Limiting Stresses, Lifestages, 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, Canon 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. 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.

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.

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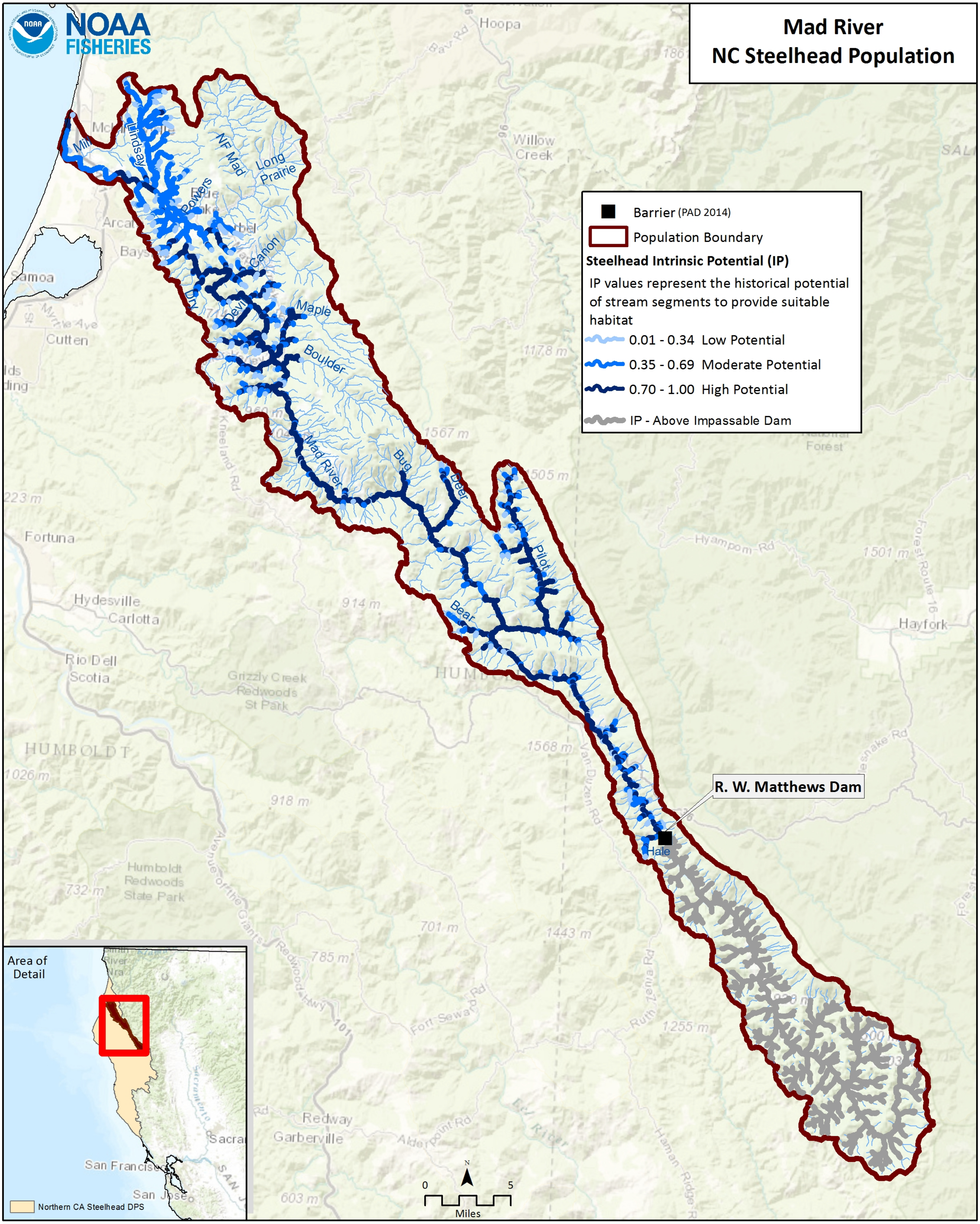

NOAA FISHERIES
Mad River
NC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
R. W. Matthews Dam
Lindsay
NF Mad
Long Prairie
Powers
Canon
Dry
Devil
Maple
Boulder
Mad River
Bug
Deer
Pilot
Bear
Hale
Hoopa
Willow Creek
Fortuna
Hydesville
Carlotta
Rio Dell
Scotia
Cutten
Samoa
Grizzly Creek Redwoods St Park
Humboldt Redwoods State Park
HUMBOLDT
Redway
Garberville
Hayfork
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
0
5
Miles

#	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
		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)		4 spawner per IP-km = >1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	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; >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% of streams/ 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	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; <18.1 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	93.51% IP-km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	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	50% to 74% of streams/ IP-Km	75% to 90% of streams/ IP-Km	>90% of streams/ IP-Km		

					(>80 stream average)	(>80 stream average)	(>80 stream average)	(>80 stream average)		
			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		
		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
		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

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28	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	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 50	Good

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
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)	>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

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	Hatcheries and Aquaculture	High		High		High		High	High
5	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
6	Fishing and Collecting	Medium		Low		Low		Low	Low
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
	Threat Status for Targets and Project	High	Medium	High	High	High	High	High	Very High

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	283					283	Cost based on estuary use/residence time model at a rate of $282,233/project.
MadR-NCSW-1.1.1.2	Action Step	Estuary	Remove or set back levees, guided by assessment.	2	8	County of Mendocino						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
MadR-NCSW-1.1.1.3	Action Step	Estuary	Assess tidally influenced habitat and develop plan to restore tidal channels.	2	2	CDFW						TBD	Cost accounted for in above action step.
MadR-NCSW-1.1.1.4	Action Step	Estuary	Restore tidal wetlands and tidal channels, guided by plan.	2	8	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation. Cost should be coordinated with other action steps above to reduce cost and redundancy.
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-2.1.1.2	Action Step	Floodplain Connectivity	Assess watershed and prioritize potential refugia habitat sites.	3	2	CDFW	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.
MadR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Implement projects that create refugia habitats, guided by assessment.	3	8	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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	WCB						0	Action is considered In-Kind
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	34					34	
MadR-NCSW-5.1.1.2	Action Step	Passage	Implement plan.	3	8	CDFW						TBD	Cost for providing passage based on amount of barriers and methods to improve passage conditions. Cost range between $85,232 to $992,479/project.
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-6.1.1.2	Action Step	Habitat Complexity	Develop plan to add large wood, boulders, or other instream structure to specific areas in specific quantities.	3	2	CDFW	115					115	Cost based on fish/habitat restoration model at a rate of $114,861/project.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
MadR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Place instream structures, guided by assessment.	3	8	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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						0	Action is considered In-Kind
MadR-NCSW-7.1.1.2	Action Step	Riparian	Plant conifers, guided by prescription.	3	10	CalFire						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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.	3	5	CDFW						TBD	Cost depends on the amount of reed grass that needs to be removed from the channel.
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						0	Action is considered In-Kind
MadR-NCSW-17.1.1.2	Action Step	Hatcheries	Consult on MRH HGMP.	3	1	CDFW						0	Action is considered In-Kind
MadR-NCSW-17.1.1.3	Action Step	Hatcheries	Reduce straying of hatchery steelhead based on HGMP.	3	2	CDFW						0	Action is considered In-Kind
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	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.
MadR-NCSW-18.1.1.2	Action Step	Livestock	Develop grazing management plan to meet objective.	3	2	RWQCB						0	Action is considered In-Kind
MadR-NCSW-18.1.1.3	Action Step	Livestock	Fence livestock out of riparian zones.	3	5	Private						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
MadR-NCSW-18.1.1.4	Action Step	Livestock	Plant vegetation to stabilize stream bank.	3	5	Private						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
MadR-NCSW-18.1.1.5	Action Step	Livestock	Relocate instream livestock watering sources.	3	2	Private						TBD	Cost based on amount of off-channel watering sources needed. Cost estimate for off-channel water source is $5,000/site.
MadR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action is considered In-Kind
MadR-NCSW-19.1.1.2	Action Step	Logging	Apply BMPs for timber harvest.	3	2	CalFire						0	Action is considered In-Kind
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)										
MadR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Minimize mass wasting	3	5		400.00					400	Cost based on erosion reduction across 10% total watershed acres.
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	2,107					2,107	
MadR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission roads, guided by assessment, away from unstable land features	3	10	Private						TBD	Cost based on amount of road network to decommission based on road inventory.
MadR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	10	Private						TBD	Cost based on amount of road network to upgrade. Cost to upgrade estimate at $21,000/mile.
MadR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Relocate roads away from unstable features.	3	10	Private Landowners						TBD	Cost based on amount of road network to relocate.
MadR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	2	Private						0	Action is considered In-Kind
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							0	Action is considered In-Kind
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						TBD	Cost based on amount of participation from water users. Cost estimate at $70,000/landowner.
MadR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flow	3	2	CDFW						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
MadR-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer	3	2	RWQCB						TBD	Cost based on amount of incentives to provide to reduce summer low-flow. Currently, incentive programs exist and should be expanded and explored.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind

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/).

Steelhead 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) currently conducts snorkel, electrofishing, and spawning surveys throughout the Maple Creek watershed (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 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 patters 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 land-owners 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.

Population and Habitat 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 has 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 proposes to address 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.

Literature Cited

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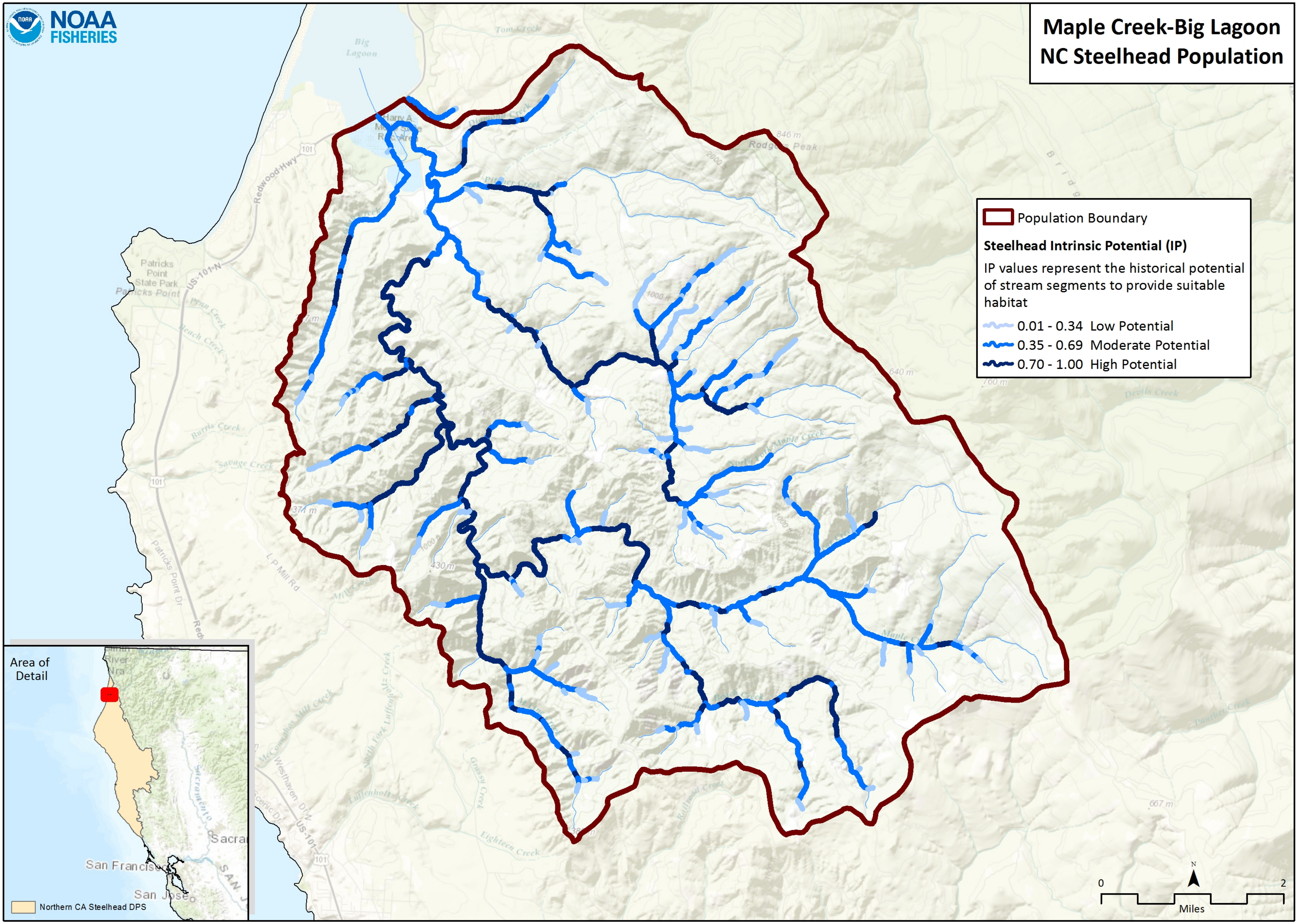

NOAA FISHERIES
Maple Creek-Big Lagoon
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of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

#	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; >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)	50% to 74% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)	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; <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)	100% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	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)		
			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		
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

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
4	Hatcheries and Aquaculture	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
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
	Threat Status for Targets and Project	High	High	Very High	Very High	High	Very High	Very High

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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.	3	5	NMFS	283.00					283	Cost based on estuary assessment at a rate of $282,233/project.
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.	3	5	CDFW, Green Diamond Resource Company	684					684	Cost based on treating 1 dam, unknown height; partial/temporal barrier at a rate of $684,907.
MapC-NCSW-1.1.2.2	Action Step	Estuary	Remove Gray Creek dam, guided by assessment.	3	5	CDFW, Green Diamond Resource Company							Cost accounted for in above action step.
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.	2	5	CDFW, Green Diamond Resource Company	115.00					115	Cost based on fish/habitat restoration at a rate of 114,861/project.
MapC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Restore the historic floodplain, guided by the plan.	2	10	CDFW, Green Diamond Resource Company						TBD	Cost based on amount of habitat to restore. Cost estimated at a rate of $37,200/acre.
MapC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MapC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										
MapC-NCSW-6.1.2.2	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						TBD	Cost based on amount of LWD needed. Cost estimated at $104,000/ELJ or $26,000/mile.
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-8.1.1.2	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						TBD	Cost should be in coordination with habitat complexity action steps.
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										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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.	3	20	CDFW	70.75	70.75	70.75	70.75		283	Cost based on estuary assessment at a rate of $282,233/project.
MapC-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Control New Zealand Mud Snails guided by assessment.	3	30	CDFW						TBD	Cost based on amount to treat and method to apply.
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.	3	10	CDFW						TBD	Cost accounted for in above action step
MapC-NCSW-14.1.1.4	Action Step	Disease/ Predation/ Competition	Eradicate exotic species, guided by assessment results.	3	30	CDFW						TBD	Cost based on amount and method to treat exotic species. Cost estimated at a rate of $41,000/acre.
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						0	Action is considered In-Kind
MapC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Identify fishing impacts expected to be consistent with recovery.	3	30	NMFS						0	Action is considered In-Kind
MapC-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Determine actual fishing impacts instream and offshore 200 miles.	2	25	NMFS						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
MapC-NCSW-16.1.1.6	Action Step	Fishing/Collecting	Identify scientific collection impacts expected to be consistent with recovery.	3	25	NMFS						0	Action is considered In-Kind
MapC-NCSW-16.1.1.4	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						In-Kind	
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						0	Action is considered In-Kind
MapC-NCSW-19.1.1.2	Action Step	Logging	Thin, or release conifers guided by prescription.	3	5	Green Diamond Resource Company						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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.	3	10	Green Diamond Resource Company	67.50	67.50				135	Cost based on road inventory 141 miles of road network at a rate of $957/mile.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
MapC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	10	Green Diamond Resource Company						TBD	Cost based on the amount of road needing to be decommissioned at a rate of $12,000/mile.
MapC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	20	Green Diamond Resource Company						TBD	Cost will be based on the amount of road that needs to be upgraded at a rate of $46,415/mile.
MapC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	25	Green Diamond Resource Company						0	Action is considered In-Kind
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.	3	20	Caltrans, CDFW, NMFS						0	Action is considered In-Kind
MapC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Install bridges, guided by plan.	3	25	Caltrans, CDFW, NMFS						TBD	Cost will depend on bridge design and practices, may be In-Kind.
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						0	Action is considered In-Kind

Mattole River Population

NC Steelhead Winter-Run and Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal
- Spawner Abundance Target: 10,700 adults
- Current Intrinsic Potential: 534.5 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/).

Steelhead Abundance and Distribution

The Mattole River contains two reproductive run-timing ecotypes of steelhead, summer-run which 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 a 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 the 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 the number of live adult fish observed on spawning grounds during the three most recent survey years has been 501 (2011-12), 1456 (2012-13), and 528 (2013-14) (MSG 2015). The number of live fish reported is not a population estimate or a watershed-wide census because survey effort and focus varied each the years based on available funding. The number of redds per survey mile (escapement index) has been observed since the mid-1990s, and peaked at 0.41 redds/mile in 2012-13.

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.* 2003). Based on summer steelhead dive observations, juveniles are rearing throughout the Mattole River watershed (MRRP 2009). 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, and 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 2009b);
- 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

Due to the low abundance of adult winter and summer steelhead, this population viability attribute was rated as Poor. Summer rearing juvenile density, spatial structure, and smolt abundance are rated as Poor across the watershed.

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 indicator was 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, water quality (turbidity and temperature), quality and extent of estuary.

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.

Population and Habitat Conditions

Viability: Density, Abundance, and Spatial Structure

Relative to historic numbers and recovery targets, the numbers of spawning adults are low in the Mattole River. Low numbers of juvenile 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.

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 lifestages 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.

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 have 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 stream beds 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 have 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 increasd 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, may 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 were 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.

Gravel-scouring conditions were rated as Fair for eggs, which is a function of watershed hydrology processes as described above.

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.

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 subdevelopment 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

[1] http://www.ncdc.noaa.gov/climate-monitoring/dyk/drought-definition; Accessed January 10, 2013
[2] http://www.cpc.ncep.noaa.gov/products/outreach/glossary.shtml; Accessed January 10, 2013

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 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 and subsequent implementation of the Integrated Resource Management Plan (2006). 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, and 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, need to continue and include provisions to minimize erosion and maintain water quality.

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*. 2003; MRC 2005; MRRP 2009), *e.g*., sub-basin delineation, action prioritization, social capital of existing private/public partnerships, completed and ongoing habitat restoration and streamflow improvement projects. To insure 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 (McBain and Trush 2012; Trout Unlimited *et al*. 2012), as a model for other sub-basins.

Improve Floodplain Connectivity and 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 will provide much-needed complexity to 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.

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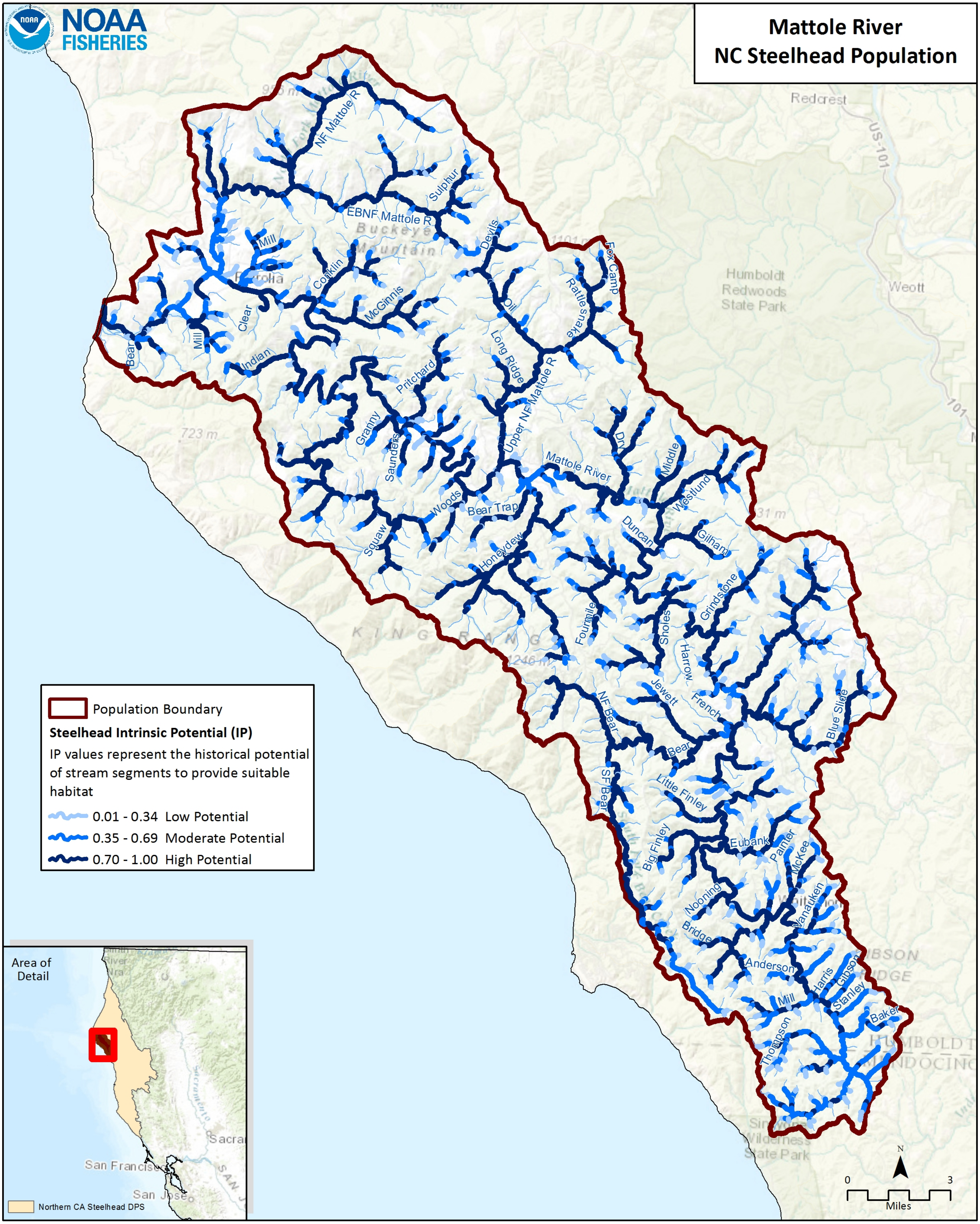
NOAA FISHERIES
Mattole River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
Redcrest
US-101
Humboldt Redwoods State Park
Weott
KING RANGE
723 m
1246 m
NF Mattole R
Sulphur
EBNF Mattole R
Buckeye Mountain
Mill
Petrolia
Conklin
Devils
Fox Camp
Rattlesnake
Oil
McGinnis
Clear
Mill
Bear
Indian
Long Ridge
Pritchard
Upper NF Mattole R
Granny
Saunders
Dry
Middle
Mattole River
Westlund
Woods
Bear Trap
Squaw
Duncan
Gilham
Honeydew
Grindstone
Fourmile
Shoales
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
0
3
Miles
N

#	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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	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; >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)	52% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)	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; <18.1 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	53.33% 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
			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	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	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)	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)		
			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		
		Size	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/nonfunctional	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
			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
		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)		<61,400, Smolt abundance which produces high risk spawner density per Spence (2008)	Poor
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	29.15	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)		<12,300, <1 Spawner per IP-km (Reference Spence)	Poor

	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	Hatcheries and Aquaculture	Low		Low		Low		Low	Low
5	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low	Low
6	Fishing and Collecting	Low		Low		Low		Low	Low
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
	Threat Status for Targets and Project	High	High	Very High	High	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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	Develop a plan to restore freshwater wetlands to brackish wetlands.	2	2	BLM	214.00					214	Cost based wetland restoration at a rate of $213,307/project.
MatlR-NCSW-1.1.1.2	Action Step	Estuary	Convert areas identified in plan to functioning tidal habitat.	3	5	BLM						TBD	Cost based on amount of habitat to be restored. Cost estimated at $37,200/acre.
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 plan to recreate off-channel ponds, alcoves, and backwater habitat.	2	10	BLM	57.50	57.50				115	Cost based on fish/habitat restoration assessment estimated at $114,861/project. Cost should be in coordination with other action steps.
MatlR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Recreate habitat guided by plan.	2	20	Private						TBD	Cost based on amount of habitat. Cost estimated at $41,000/acre.
MatlR-NCSW-2.1.1.5	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	2	20	NGO						0	Cost accounted for in action steps above.
MatlR-NCSW-2.1.1.6	Action Step	Floodplain Connectivity	Re-connect the floodplain, guided by assessment.	2	20	BLM						0	Cost accounted for in above action steps.
MatlR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MatlR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
MatlR-NCSW-3.1.1.1	Action Step	Hydrology	Work with the counties and SWRCB to ensure sub-division of existing parcels does not result in increased water demand during low-flow season.	2	10	Counties, SWRCB						0	Action is considered In-Kind
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						TBD	
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	Increase large wood frequency										
MatlR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	10	CDFW	57.50	57.50				115	Cost based on fish/habitat restoration. Cost estimated at $114,861/project..
MatlR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Add structure, guided by plan.	2	25	NGO						0	Cost accounted for in action step above.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
MatIR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
MatIR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Develop plan to recreate off-channel ponds, alcoves, and backwater habitat	2	20	NGO						0	Cost accounted for in FLOODPLAIN CONNECTIVITY.
MatIR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Implement actions to increase the frequency of pool habitats	2	25	NGO						0	Cost accounted for in FLOODPLAIN CONNECTIVITY.
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	Reduce turbidity and suspended sediment										
MatIR-NCSW-10.1.1.1	Action Step	Water Quality	Assess potentially large inputs of fine sediments (e.g., landslides, failed culvert)	2	10	CDFW, RWQCB, Counties	120.00	120.00				240	Cost based on erosion assessment of 10% of total watershed acres at a rate of $12.62/acre.
MatIR-NCSW-10.1.1.2	Action Step	Water Quality	Develop plan to reduce large inputs of fine sediments	3	25	CDFW, RWQCB, Counties						TBD	Cost based on amount of acres needing treatment. Methods and practices to treat erosion vary widely and depend on type and location of erosion.
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 reduced density, abundance, and diversity based on the biological recovery criteria										
MatIR-NCSW-12.1.1.1	Action Step	Agriculture	Determine effects of marijuana cultivation.	2	20	NMFS						TBD	
MatIR-NCSW-12.1.1.2	Action Step	Agriculture	Assess cumulative effects (e.g., flow, water quality) of marijuana cultivation.	2	20	NMFS						TBD	
MatIR-NCSW-12.1.1.3	Action Step	Agriculture	If needed, develop plan to reduce effects of marijuana cultivation.	2	20	NMFS						TBD	
MatIR-NCSW-12.1.1.4	Action Step	Agriculture	Implement plan.	2	20	NMFS						TBD	
MatIR-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MatIR-NCSW-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
MatIR-NCSW-14.1.1.1	Action Step	Disease/ Predation/ Competition	Remove invasive species that inhibit establishment of native riparian vegetation.	2	20	NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
MatIR-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Plant native riparian species in open areas.	2	20	NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
MatlR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Section 8.00 (b) low flow restrictions.	2	5	CDFW, NMFS						0	Action is considered In-Kind
MatlR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MatlR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to water quality (instream water temperature)										
MatlR-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	10	NRCS, RCD	60.00	60.00				120	Cost based erosion assessment of 5% of total acres at a rate of $12.62/acre.
MatlR-NCSW-18.1.1.2	Action Step	Livestock	Install fence, guided by plan.	2	25	Private						TBD	Cost based on amount of area to be fenced identified from assessment. Cost estimated at $3.63/ft.
MatlR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MatlR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
MatlR-NCSW-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription to increase DBH of conifers.	3	30	NGO						0	Action is considered In-Kind
MatlR-NCSW-19.1.1.2	Action Step	Logging	Plant conifers as guided by prescription.	2	20	NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
MatlR-NCSW-19.1.1.3	Action Step	Logging	Thin, or release conifers guided by prescription.	2	20	Private						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
MatlR-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to water quality (instream water temperature)										
MatlR-NCSW-19.1.2.1	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.	2	10	CDFW						0	Action is considered In-Kind
MatlR-NCSW-19.1.2.2	Action Step	Logging	Work with Calfire and private landowners through the timber harvest permitting process to manage forests in identified areas to increase shade, guided by plan.	3	20	Calfire, CDFW, Private Landowners						TBD	Cost based on identified habitat to be managed.
MatlR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
MatlR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
MatlR-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						0	Action is considered In-Kind
MatlR-NCSW-19.2.1.2	Action Step	Logging	Apply BMPs for timber harvest	3	100	Private						0	Action is considered In-Kind
MatlR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**										
MatlR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
MatlR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess streamside roads and prioritize sites for relocation.	2	20	NGO						0	Cost accounted for in below action step
MatlR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Identify and prioritize existing roads that are no longer necessary for silvicultural operations.	2	30	NGO	364.76	364.76				730	An inventory of roads will prioritize entire road network and identify roads no longer needed for silvicultural operations.
MatlR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain/stabilize roads and hill slopes, guided by assessment.	3	100	NGO, Private						0	This recommendation should be considered standard practice. Cost to maintain roads should be part of ongoing practices.
MatlR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	50	Private						TBD	Cost based on amount of road network needing upgrading. Cost to upgrade roads estimated at $21,000/mile.
MatlR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Relocate roads away from unstable land features.	3	20	CDFW, Private						TBD	Cost based on amount of road network needing to be relocated. Cost for road decommissioning estimated at $12,000/mile. Assume additional cost for new road construction.
MatlR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Develop plan to decommission roads.	3	30	NGO						0	Cost accounted for in road inventory.
MatlR-NCSW-23.1.1.8	Action Step	Roads/Railroads	Decommission roads throughout watershed.	3	20	Private						TBD	Cost based on amount of road network needing to be decommissioned. Cost to decommission estimated at $12,000/mile.
MatlR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
MatlR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
MatlR-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						0	Action is considered In-Kind
MatlR-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MatlR-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)										
MatlR-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Review authorized diversions for opportunities to increase instream flow during summer low flow period.	2	50	CDFW, SWRCB						0	Action is considered In-Kind
MatlR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer.	3	20	CDFW, SWRCB						TBD	Cost for amount of incentives necessary to reduce diversions during the summer is unknown. Several incentive programs currently exist and should be explored as potential collaborators.
MatlR-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Identify unauthorized diversions.	3	25	CDFW, SWRCB						0	Action is considered In-Kind
MatlR-NCSW-25.1.1.4	Action Step	Water Diversion /Impoundment	Create water budgets to avoid over-allocating water diversions.	3	20	CDFW, SWRCB						TBD	
MatlR-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
MatlR-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (stream flow)										
MatlR-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.	3	40	RQCB, SWRCB, CDFWRQCB, SWRCB, CDFW						TBD	Cost based on amount to decrease diversions during low flow periods. Cost for water right acquisition estimated $155/acre ft./yr.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
MatlR-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flow.	3	5		3.00					3	Cost based on a minimum of 3 gauges at a rate of $1,000/gauge. Cost does not account for data management or maintenance.

Redwood Creek Population (Upper and Lower)

NC Steelhead Winter-Run and Summer-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Northern Coastal and North Mountain Interior
- Spawner Abundance Target: 5,400 adults
- Amount of Potential Habitat: 234.9 miles/378.1 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/).

Steelhead 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 SON (DIDSON) unit has also been in mainstem Redwood Creek from 2009 to the present to help determine adult abundance. 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 (less than 0.10) negative trends over the study years between 2000 and 2010 (Sparkman 2011c). Sparkman (2011c) 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 2011b).

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 (Sparkman pers. comm. 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.

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 (2011b; 2011a) 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, end in March or April, and winter run steelhead adults continue to enter the system and spawn in May in most years (Sparkman pers. comm. 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, pers. comm. 2015) near the upper outmigrant trap site. Regarding the summer-run steelhead population, over the course of 14 years, 0-44 adult summer-run steelhead were observed during snorkel surveys in a 16-mile index reach of mainstem Redwood Creek (Anderson 2005). 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. In addition, Duffy's (2011) monitoring in Prairie Creek 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 pers. comm. 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 2010b). Recent analysis (NHE 2010b) 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.

Population and Habitat 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 canyon. 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 (Anderson 2006). 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 during most of the year to the South Slough and

Strawberry Creek, the two remaining off-channel habitats in the estuarine area. Specifically, the diversion culverts are closed during winter and spring, limiting access to habitat that provides shelter from high water velocities. 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. The middle section of the Redwood Creek basin contains summer water temperatures where the maximum weekly maximum temperatures (MWMT) ranged from 23 to 27°C, as measured during thermal infrared imaging during the summer of 2003. Madej *et al.* (2006) describes this 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 canyon of 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 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 this lifestage. In addition, the reduced abundance and density of winter steelhead adults, summer rearing steelhead juveniles, and smolts is a high stress to the population.

Over the course of 14 years, 0-44 adult summer-run steelhead were observed during surveys in a 16-mile index reach of mainstem Redwood Creek (Anderson 2005). 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 (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 (Sparkman pers. comm. 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 (Sparkman pers. comm. 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. 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 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 USFWS 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. Due to conversion of riparian areas to agriculture, construction of flood control levees, and riparian vegetation removal for flood control in the leveed reach of Redwood Creek, as well as past harvest of coniferous trees within the riparian zone during logging, the riparian species composition has been altered, contains far fewer coniferous trees, and in the case of lower Redwood Creek, most of the riparian vegetation has been removed. 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. 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

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 have been, and continue to be made, to upgrade and remove roads to reduce their sediment generating potential, road density remains high, but 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). Sediment Transport from roads conditions have a rating of Poor for watershed processes.

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, 1/17/13) 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, 1/17/13). 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 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.

Population and Habitat Threats

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 to the beginning of the steeper stream channel that is contained in a canyon. As previously discussed, over 50 percent of the estuary has been lost through the construction of levees (Anderson 2006), 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.

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 2011d) 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; 2011b) 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 (Anderson, D. G. Redwood National and State Parks, personal communication 11/30/2011; Sparkman, M. D. 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 from lower and middle Redwood Creek during the winter when it is transported downstream by high flows and 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 also 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

Mining, which for Redwood Creek is 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 that are all 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. Studies (NHE 2010b; 2010a) have shown that the flood control project was not designed to transport gravel through the leveed reach, but rather 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). 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 (Bajjaliya, CDFW, pers. comm. 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 threat and stress analysis within the CAP workbooks indicates that the summer adult, summer and winter rearing juveniles and smolt lifestages of steelhead are limiting the viability of the steelhead population. The degraded condition of the estuary, disconnection from floodplain habitat, impaired summer water temperatures, lack of habitat complexity, including reduced shelter and cover elements, an in-river sport fishery, and limited deep holding pools are all factors limiting steelhead abundance. Diversity and variation in life history is also at risk due to the stresses and threats facing adult steelhead, juveniles 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. All of the salmonid species present in the Redwood Creek watershed are highly dependent on the estuary and on low gradient tributaries and off-channel habitats. 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 sediment inputs by continuing to remove and upgrade roads, reducing instream gravel removal, and minimizing removal of LWD from stream channels.

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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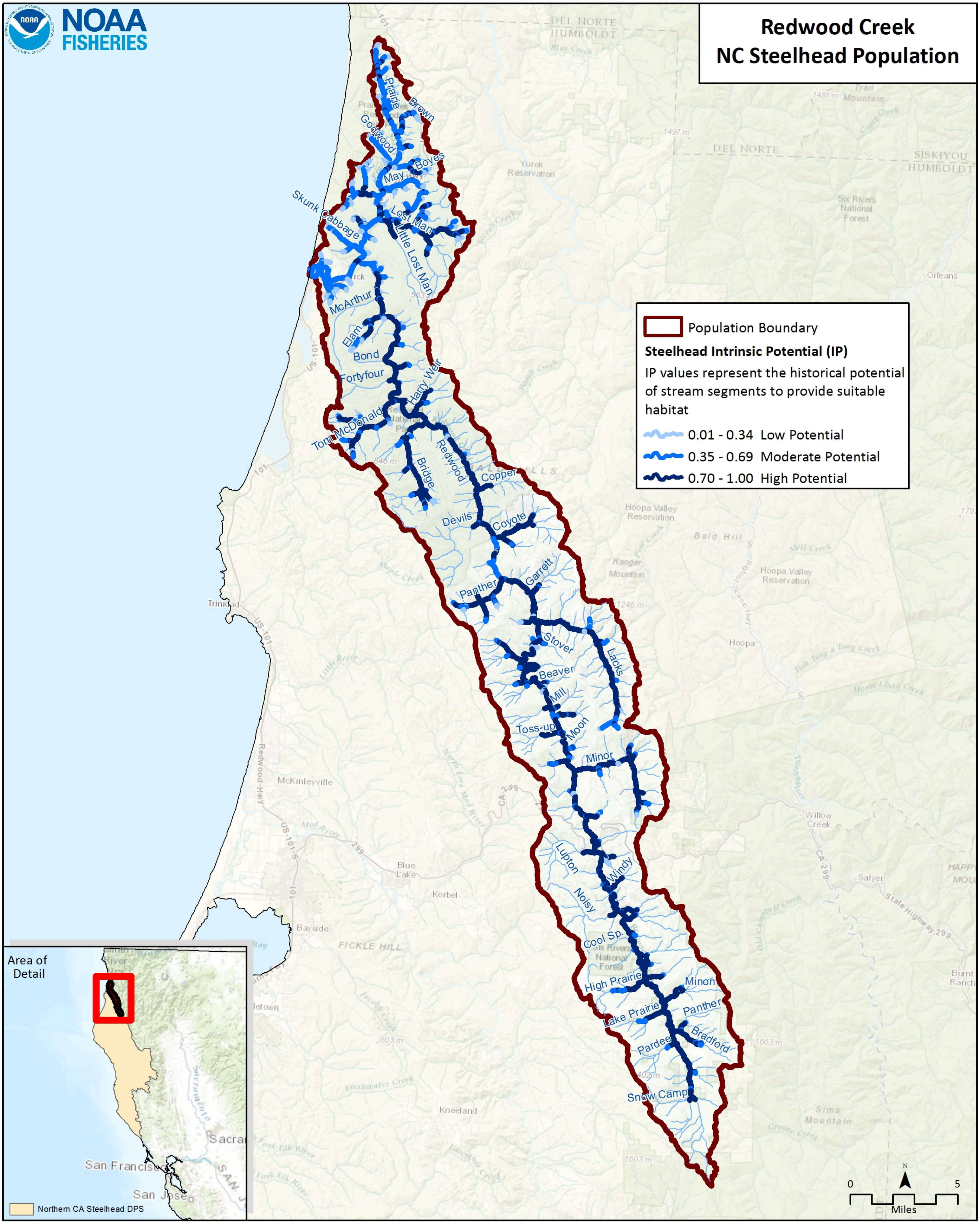
Redwood Creek
NC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Prairie
Brown
Godwood
Boyes
May
Skunk Cabbage
Lost Man
Little Lost Man
McArthur
Elam
Bond
Fortyfour
Harry Weir
Tom McDonald
Bridge
Redwood
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
DEL NORTE
HUMBOLDT
SISKIYOU
Yurok Reservation
Six Rivers National Forest
Orleans
Hoopa Valley Reservation
Hoopa
Trinidad
McKinleyville
Blue Lake
Korbel
Bayside
FICKLE HILL
Kneeland
Willow Creek
Salyer
Sims Mountain
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
0
5
Miles
N

#	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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	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 = 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; >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)	54% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	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; <18.1 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	<50% 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
			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	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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	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	50% to 74% of streams/ IP-Km	75% to 90% of streams/ IP-Km	>90% of streams/ IP-Km		

					(>80 stream average)	(>80 stream average)	(>80 stream average)	(>80 stream average)		
			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		
		Size	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
		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)		>30,100: Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	30-40	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	0.09% 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	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 = 67	
			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

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	Hatcheries and Aquaculture	Low		Low	Low	Low		Low	Low
5	Fire, Fuel Management and Fire Suppression	Low		Medium	Medium	Medium	Low	Medium	Medium
6	Fishing and Collecting	Medium		Low		Low		High	Medium
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
	Threat Status for Targets and Project	High	Medium	Very High	Very High	Very High	High	Very High	Very 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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	115.00					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
NnCRd-NCSW-1.1.1.2	Action Step	Estuary	Remove setbacks and levees, guided by assessment.	1	10	USACE						TBD	Cost based on amount of habitat to treat. Cost for floodplain connectivity estimated at $37,200/acre.
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	County	283.00					283	Cost based on estuary use/residence time monitoring at a rate of $282,233/project.
NnCRd-NCSW-1.1.2.2	Action Step	Estuary	Restore tidal wetlands and tidal channels, guided by plan.	1	10	USACE						TBD	Cost based on amount of tidal estuary to restore. Cost for estuary restoration projects estimated at $41,000/acre.
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	115.00					115	Cost based on fish/habitat restoration monitoring at $114,861/project.
NnCRd-NCSW-1.2.1.2	Action Step	Estuary	Modify flood control project to address design flaws and amend criteria.	1	10	USACE						TBD	Cost based on practices and projects to address design flaws.
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	Calfire, CDFW	115.00					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project. This action step should coordinate with other action steps.
NnCRd-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Re-connect the floodplain, guided by assessment.	1	10	Calfire, CDFW						TBD	Lower river, Redwood Valley, Prairie Creek, and other low gradient areas. Cost for floodplain restoration projects estimated at $37,200/acre with the assumption of 1 project/mile in 25% high IP.
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.	2	3	Calfire, CDFW						0	Cost accounted for in above action step.
NnCRd-NCSW-2.1.2.2	Action Step	Floodplain Connectivity	Implement projects that create refugia habitats, guided by assessment.	2	10	Calfire, CDFW						0	Cost accounted for in action step above.
NnCRd-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
NnCRd-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
NnCRd-NCSW-5.1.1.1	Action Step	Passage	Modify operation of diversion culverts in South Slough.	1	1	NPS	213					213	Cost based on providing passage at 5 stream crossings at a rate of $42,616.
NnCRd-NCSW-5.1.1.2	Action Step	Passage	Increase passage into Strawberry Creek.	1	2	NPS	43.00					43	Cost based on improving passage at a rate of $42,616/project.
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 shelters.										
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	115.00					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project. This recommendation should be coordinated with other action steps to reduce redundancy.
NnCRd-NCSW-6.1.1.2	Action Step	Habitat Complexity	Restore habitat complexity in identified areas.	2	5	NPS						TBD	Cost based on amount of habitat needed to be restored. Cost estimated at $26,000/mile with in project/mile in 50% high IP.
NnCRd-NCSW-6.1.1.3	Action Step	Habitat Complexity	Implement actions to increase the frequency of pool habitats.	2	10	NPS						0	Cost accounted for in action steps above.
NnCRd-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency										
NnCRd-NCSW-6.1.2.1	Action Step	Habitat Complexity	Assess specific reaches lacking LWD and and develop prescription to increase habitat complexity	2	5	NPS						TBD	Costs will vary with number of reaches surveyed and level of detail for prescriptions to be developed.
NnCRd-NCSW-6.1.2.2	Action Step	Habitat Complexity	Thin, or release conifers guided by prescription.	2	10	NPS						TBD	Cost based on area to be treated. Cost for riparian thinning estimated at $1,468/acre.
NnCRd-NCSW-6.1.2.3	Action Step	Habitat Complexity	Assess habitat to determine locations and amount of instream structure needed.	2	2	NPS						0	Cost accounted for in above action step.
NnCRd-NCSW-6.1.2.4	Action Step	Habitat Complexity	Place instream structures, guided by assessment.	2	5	NPS						TBD	Cost based on amount of habitat to be treated. Cost for instream complexity estimated at $26,000/mile with 1 project/mile in 50% high IP.
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 establishment of native riparian vegetation.	2	1	NPS						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
NnCRd-NCSW-7.1.1.2	Action Step	Riparian	Plant native riparian species in open areas.	2	20	NPS						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
NnCRd-NCSW-7.1.1.3	Action Step	Riparian	Retain riparian vegetation in flood control project reach.	1	10	USACE						0	Action is considered In-Kind
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	Improve quantity and distribution of spawning gravels										

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NnCRd-NCSW-8.1.1.1	Action Step	Sediment	Work with the Corps and Counties through the permitting process to reduce instream gravel mining.	1	1	USACE, Counties						0	This recommendation is based on permitting and management actions and no direct cost of implementation are accounted for. Action is considered In-Kind
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	Reduce turbidity and suspended sediment										
NnCRd-NCSW-10.1.1.1	Action Step	Water Quality	Asess potentially large inputs of fine sediments (e.g., landslides, failed culverts).	3	2	NPS	229					229	Cost based on erosion assessment of 10% of total watershed acres at a rate of $12.62/acre.
NnCRd-NCSW-10.1.1.2	Action Step	Water Quality	Restore locations with large inputs of fine sediments.	3	10	NPS						TBD	Cost based on amount of locations with large inputs needing to be restored. Methods, and cost, vary depending upon type and location of sediment inputs.
NnCRd-NCSW-10.1.2	Recovery Action	Water Quality	Improve stream temperature conditions										
NnCRd-NCSW-10.1.2.1	Action Step	Water Quality	2	2	2	CalFire	74.00					74	Cost based on riparian restoration monitoring at a rate of $$73,793/project.
NnCRd-NCSW-10.1.2.2	Action Step	Water Quality	Manage forests in identified areas to increase shade, guided by plan.	2	10	CalFire						0	Action is considered In-Kind
NnCRd-NCSW-12.1	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**										
NnCRd-NCSW-12.1.1	Recovery Action	Agriculture	Prevent and minimize alterations to riparian species composition and structure	2	10	RCD, Counties							
NnCRd-NCSW-12.1.1.1	Action Step	Agriculture	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from area.	3	2		74.00					74	Cost based on riparian restoration monitoring at a rate of $73,793/project.
NnCRd-NCSW-12.1.1.2	Action Step	Agriculture	Install fence, guided by plan.	3	10	RCD, Private Landowners						TBD	Cost based on amount of fencing needed to exclude livestock from riparian areas. Cost estimated at $3.63/ft.
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.	1	10	USACE						0	Cost should be minimal as this recommendation is a management decision. Action is considered In-Kind
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						0	Action is considered In-Kind
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										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
NnCRd-NCSW-19.1.1.1	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 overtime.	2	2	CalFire						0	Cost accounted for in WATER QUALITY
NnCRd-NCSW-19.1.1.2	Action Step	Logging	Manage forests in identified areas to increase shade, guided by plan.	2	10	CalFire						0	This recommendation should be standard practice. Action is considered In-Kind
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	Conduct a road asessment to determine which are major sediment contributers or no longer needed.	2	10	NPS	56	56				112	Cost based on road assessment at a cost of $957/mile, over 50% of IP km
NnCRd-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	2	10	NPS						TBD	Cost based on miles of road identified to be decommissioned. Cost to decommission estimated at $12,000/mile.
NnCRd-NCSW-23.1.1.3	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	2	10	NPS, Private Landowners						0	Action is considered In-Kind
NnCRd-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	2	10	NPS, Private Landowners						TBD	Cost based on amount of road network to be upgraded. Cost to upgrade roads estimated at $21,000/mile.
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.	3	5	CDFW	65.00					65	Cost based on hydrological modeling at a rate of $65,084/project.
NnCRd-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Reduce diversions to level that would not limit recovery of salmonids.	3	15	CWQCB						TBD	Cost based on amount of diversions impacting salmonids and actions needed to reduce diversions. Subsequent actions could include off-channel storage, improved irrigation efficiency, etc.

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/).

Steelhead 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 (CWPAP 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 along the Lower Eel River. 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, and the Eel River Restoration Project. The following are pertinent reports or plans for the Lower Eel and South Fork Eel Rivers:

- South Fork Eel River Basin Report (CWPAP 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 (USBLM, USFS, and USFWS 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.

Population and Habitat Stresses

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 later growth and 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 clogs the interstitial spaces between gravel and so 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 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 is 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, 1/17/13). 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, 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). 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

Extended periods of high turbidity after rain events were documented in Cummings Creek, Grizzly Creek, Wolverton Gulch, and other areas of the Van Duzen basin, which is a nearby tributary of the Eel River with a similar land use history (CDFG 2012). Turbidity levels high enough to affect SONCC coho salmon health (>25 NTU) were documented in several tributaries of the Van Duzen River from 2000 to 2003 (Harkins 2004). Turbidity is rated Poor for pre-smolts, smolts, and adults, likely reflecting high sediment loads in the basin. Toxicity is rated Fair for pre-smolts, smolts, and adults. Wastewater treatment facilities affect the Lower Eel downstream of the Van Duzen (CDFG 2010). 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.

Population and Habitat Threats

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 pre-smolt 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 these 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 affect on the distribution and abundance of steelhead in the South Fork and Lower Eel River drainages. 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 considered to be neither riffles nor pools, and 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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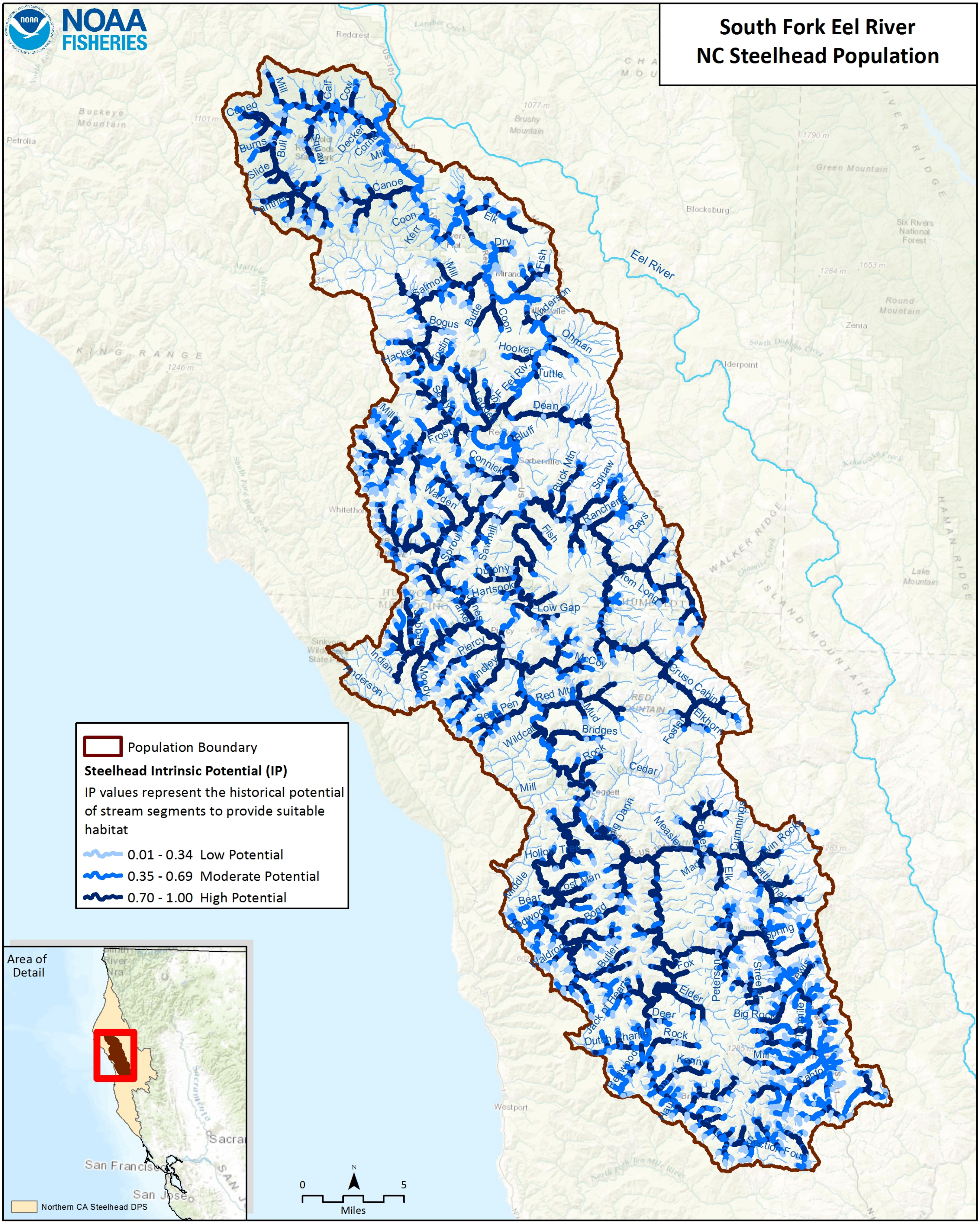
NOAA FISHERIES
South Fork Eel River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
0
5
Miles
N
Eel River
Redcrest
Petrolia
Buckeye Mountain
Brushy Mountain
Green Mountain
Blocksburg
Six Rivers National Forest
Round Mountain
Zenia
Alderpoint
KING RANGE
WALKER RIDGE
Lake Mountain
Whitethorn
Westport
Canoe
Coon
Kerr
Elk
Dry
Fish
Salmon
Bogus
Butte
Anderson
Ohman
Hooker
Tuttle
Dean
Frost
Bluff
Connick
Buck Mtn
Squaw
Ranchería
Rays
Warden
Sproul
Sawmill
Hartsook
Low Gap
Tom Long
Indian
Piercy
McCoy
Cruso Cabin
Elkhorn
Red Mtn
Mud
Bridges
Wildcat
Rock
Cedar
Mill
Cummings
Measley
Fox
Elder
Deer
Big Rock
Kenny
Middle
Bear
Bond
Waldron
Butler
Peterson
Jack of Hearts

#	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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	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 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; >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)	54% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)	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; <18.1 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	58.57% 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
			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
		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
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	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	50% to 74% of streams/ IP-Km	75% to 90% of streams/ IP-Km	>90% of streams/ IP-Km		

					(>80 stream average)	(>80 stream average)	(>80 stream average)	(>80 stream average)		
			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		
		Size	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
		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

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	37.86	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	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	
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; <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	<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

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	Hatcheries and Aquaculture	Low							Low
5	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Medium	Medium	Medium	Medium
6	Fishing and Collecting	Medium		Medium		Low		High	Medium
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
	Threat Status for Targets and Project	Medium	Medium	Very High	Medium	High	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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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-2.1.1.2	Action Step	Floodplain Connectivity	Develop a plan to recreate off-channel ponds, alcoves and backwater habitat.	2	5	CDFW, Tribes, NMFS	288.00					288	Cost based on riparian and wetland restoration model at a rate of $73,793 and $213,307/project, respectively.
SFEeR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows, guided by assessment.	2	10	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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	1,573					1,573	Cost based on adult escapement and juvenile migration model at 40 barriers at a rate of $36,379 and $188,264/project, respectively.
SFEeR-NCSW-5.1.1.2	Action Step	Passage	Restore passage, guided by plan.	2	10	CDFW						TBD	Cost dependent on the amount of barrier to be restored and the type of restoration.
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	57.50	57.50				115	Cost based on fish/habitat restoration model at a rate of $114,861/project. Cost may be higher if greater level of design and planning needed.
SFEeR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Add structure, guided by plan.	2	10	CDFW, Tribes, NMFS	2,574	2,574				5,148	Cost based on treating198 miles (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile.
SFEeR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Plant conifers guided by plan.	2	20	CDFW, Tribes, NMFS						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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.	2	5	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
SFEeR-NCSW-7.1.1.2	Action Step	Riparian	Plant native riparian species in denuded areas.	2	20	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action is considered In-Kind
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).	2	5	CDFW						0	Action is considered In-Kind
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.	2	25	CDFW						0	Action is considered In-Kind
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).	2	5	CDFW						0	Action is considered In-Kind
SFEeR-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult salmonids by increasing law enforcement.	2	5	CDFW						0	Action is considered In-Kind
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.	2	5	CDFW						0	Action is considered In-Kind
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							0	Cost accounted for in above action step.
SFEeR-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										
SFEeR-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	20							0	Action is considered In-Kind
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.	2	5	CalFire						0	Action is considered In-Kind
SFEeR-NCSW-19.1.1.2	Action Step	Logging	Plant, thin, or release conifers guided by prescription.	2	10	CalFire, CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
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.	2	5	CDFW	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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.	2	10	CalFire, CDFW						0	Action is considered In-Kind
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)										
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		141.00					141	Cost based on 141 signs at a rate of $1,000/sign.
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.	2	10	CDFW						0	Action is considered In-Kind
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						0	Action is considered In-Kind
SFEeR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	2	10	CalFire, CDFW, Counties, Private Landowners	748	748				1,496	Cost based on road inventory of 1563 miles of road at a rate of $957/mile.
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	2	10	CalFire, CDFW, Counties, Private Landowners						0	Cost accounted for in above action step.
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.	2	10	CDFW						TBD	Cost based on amount of road network to hydrologically disconnect.
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						0	Action is considered In-Kind
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.	2	20	CalFire, NMFS, Private Landowners						0	Action is considered In-Kind
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.	2	20	CalFire, CDFW, Counties, Private Landowners						0	Action is considered In-Kind
SFEeR-NCSW-23.1.1.9	Action Step	Roads/Railroads	Conduct habitat surveys to monitor change in key habitat variables	2	5	CDFW, NMFS, Private Landowners						0	Cost accounted for in the Monitoring Chapter
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						TBD	Cost based on amount of participation from water users. Cost estimate at $70,000/landowner.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
SFEeR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flow.	2	10	RWQCB						0	Action is considered In-Kind

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

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

Steelhead 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, BLM 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	1537.6	86.2
	CI +/-541.5	CI +/-368.9	
2000	5782.5	4310.0	74.5
	CI +/-618.2	CI +/-827.5	

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 well. Densities and abundance estimates for Shipman and Big creeks show similar trends observed in Spanish and Big Flat (BLM unpublished data).

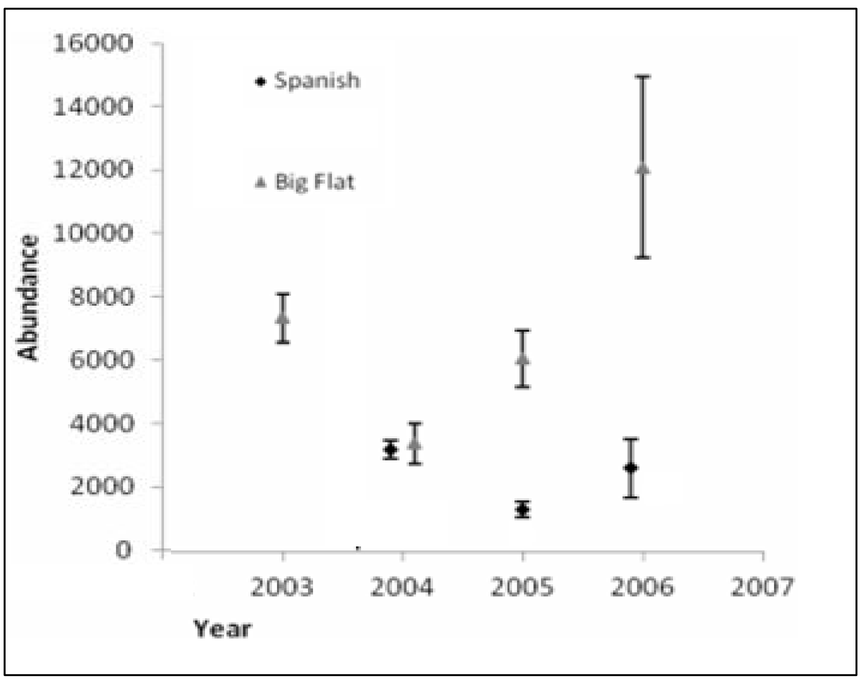

Figure 1: As modified from Figure 31 in Colombano (2012). Estimated juvenile steelhead abundance in Spanish and Big Flat creeks from 2003 to 2006. The error bars are 95% confidence intervals.

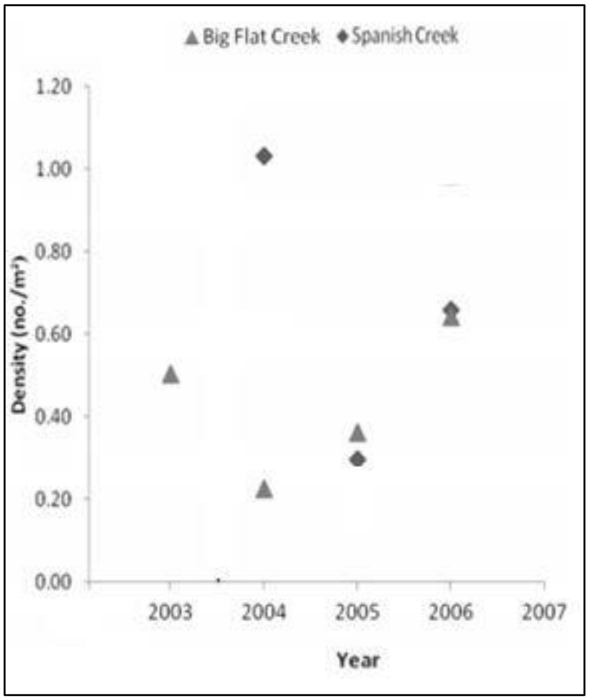

Figure 2: As modified from Figure 35 in Colombano (2012). The density (number per m²) of juvenile steelhead trout in the study reaches of Spanish and Big Flat creeks, King Range National Conservation Area.

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 KRCA (McNutt Gulch, Guthrie, Oil and Jackass creeks).

The KRNCA is regarded as pristine landscape, because the KRCA was not settled as densely as other parts of the North Coast region. Consequently, the KRCA 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 (BLM 2004). Currently, management within the KRCA is limited to a few roads, isolated homesteads, camping and hiking trails, and was never dominated by a single industry (BLM 2004).

Relative to the watersheds in the KRCA, 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 *et al.* 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 (Bodin *et al.* 1982; Raphael 1974). 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 KRCA 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 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, and Winter Rearing Juvenile lifestages; as well as Fair for 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 KRCA 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 (personal communication A.J Donnell BLM and Dan Wilson NMFS) (see Photo 1). Despite good LWD loading in the KRCA 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.

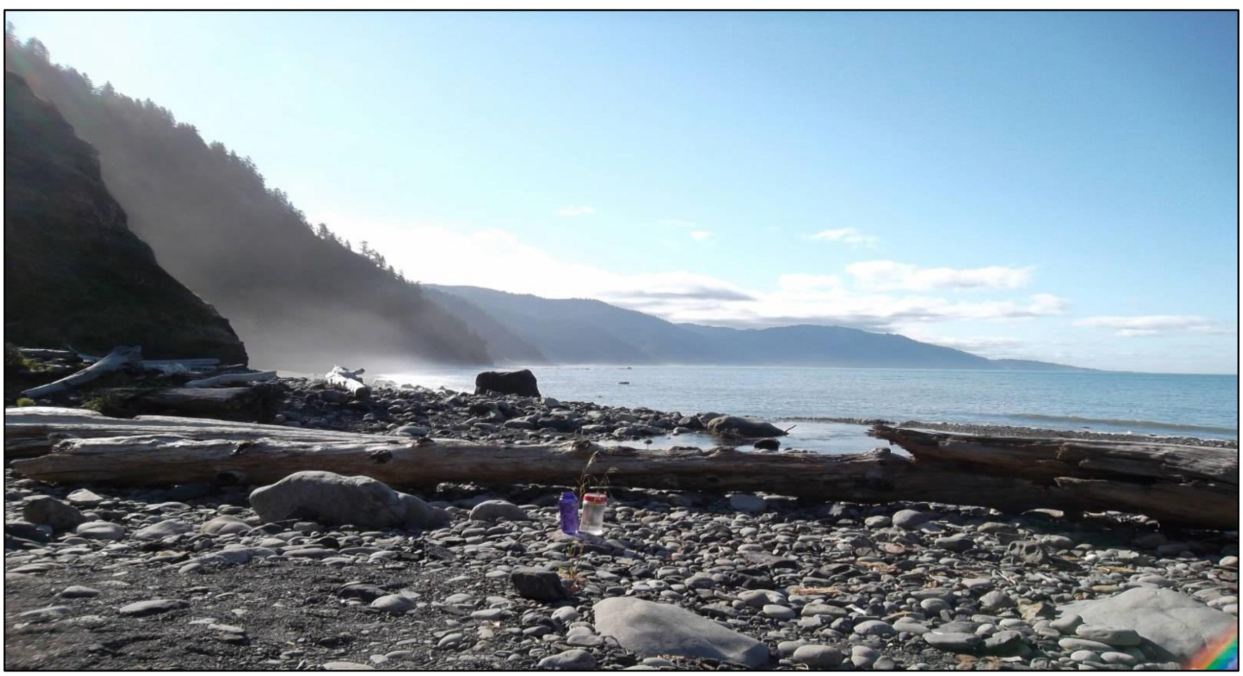

Photo 1: Abundant LWD at the mouth of Shipman creek in King Range Conservation Area. May 29, 2010. Photo Courtesy: Dan Wilson, NMFS.

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 KRCA watersheds insufficient data on the KRCA 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 (personal communication A.J. Donnell BLM, personal communication Dan Wilson NMFS). 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.* 1982, 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. BLM estimates that current usage of the Lost Coast trail to be 153,731-190,109 visitor days annually (BLM 2004). BLM 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 KRCA 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 KRCA 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 (personal observation, May 29, 2010, Dan Wilson NMFS). 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 KRCA 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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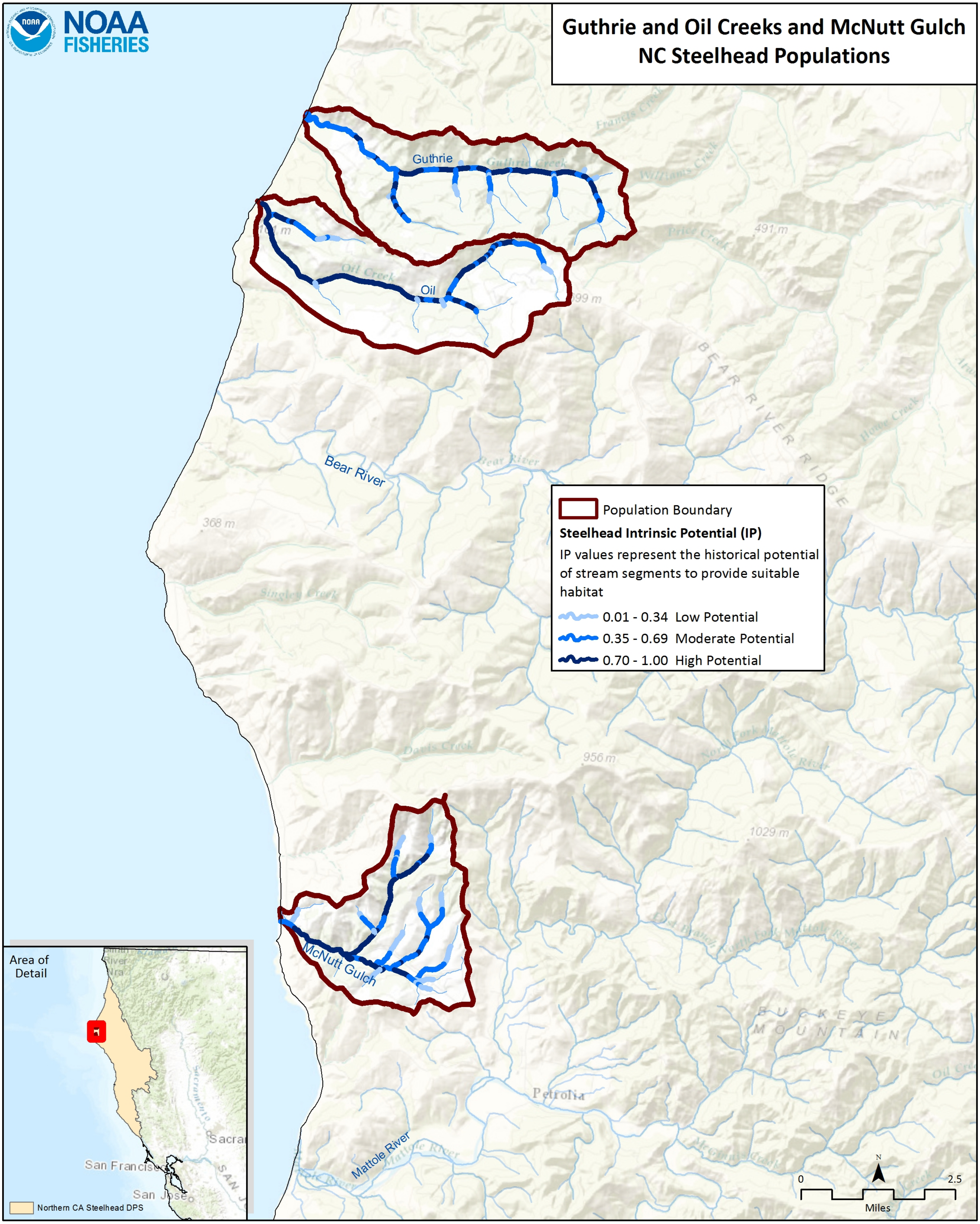
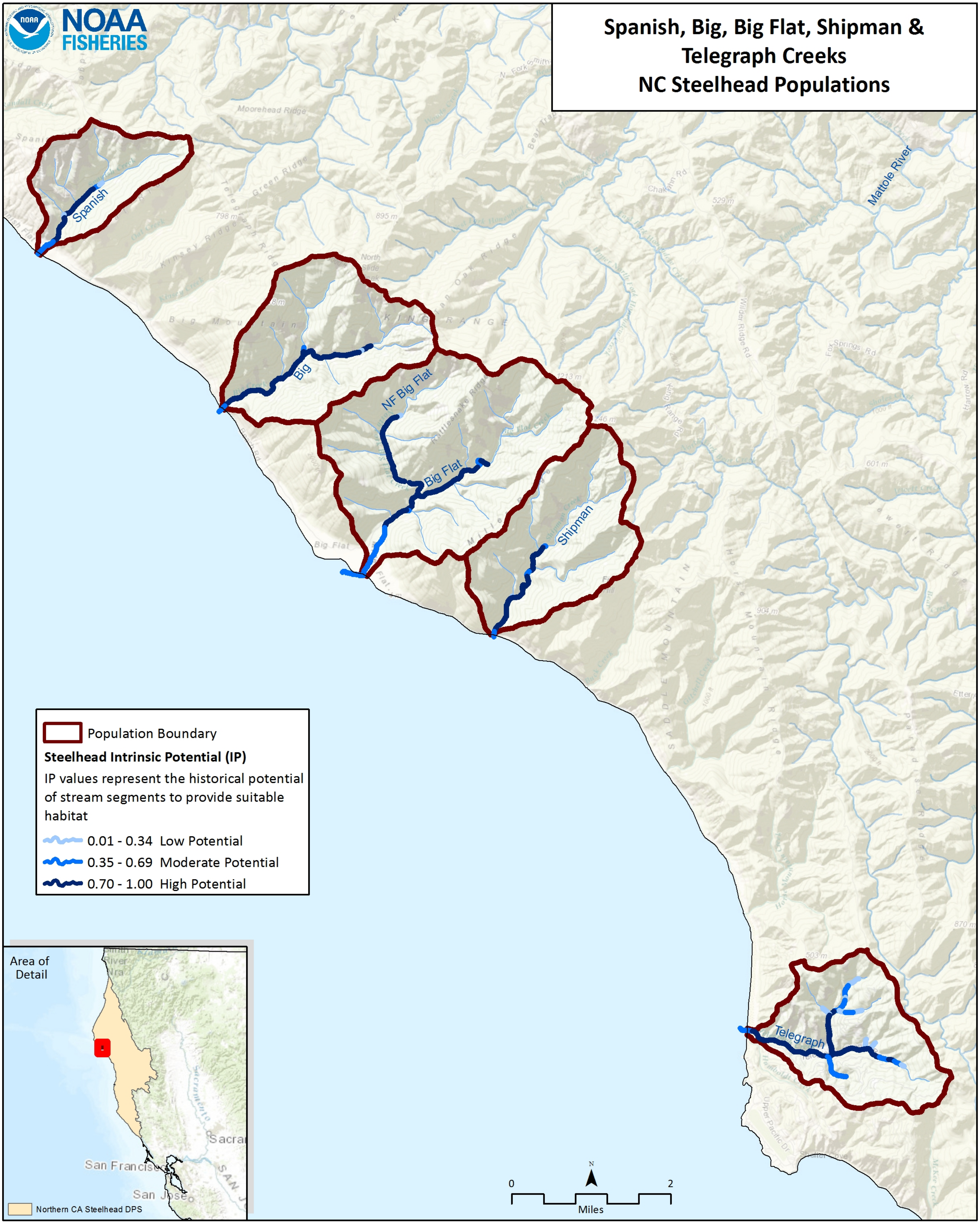
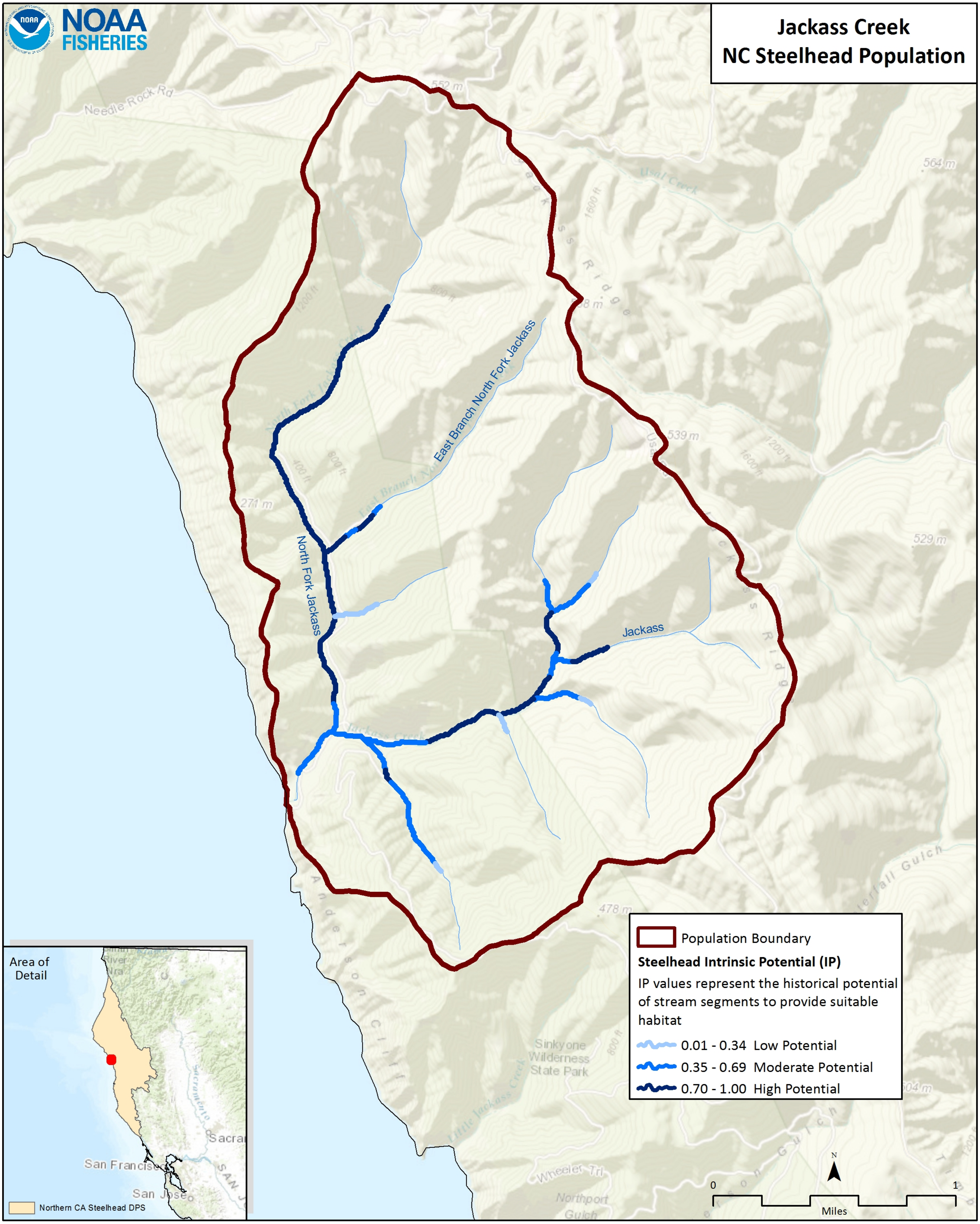

NOAA FISHERIES
Guthrie and Oil Creeks and McNutt Gulch
NC Steelhead Populations
Guthrie
Guthrie Creek
Francis Creek
Williams Creek
Oil Creek
Oil
Price Creek
491 m
399 m
BEAR RIVER RIDGE
Bear River
368 m
Singley Creek
Davis Creek
956 m
1029 m
North Fork Mattole River
McNutt Gulch
BUCKEYE MOUNTAIN
Petrolia
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
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
0
2.5
Miles
N


NOAA FISHERIES
Spanish, Big, Big Flat, Shipman & Telegraph Creeks NC Steelhead Populations
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
Usal Creek
East Branch North Fork Jackass
North Fork Jackass
Jackass
Jackass Creek
Anderson Cliff
Little Jackass Creek
Sinkyone Wilderness State Park
Wheeler Trl
Northport Gulch
552 m
564 m
539 m
529 m
271 m
478 m
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 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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
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	186	186				372	Cost based on treating 0.5 miles (assume 1 project/mile in 25% high IP with 20 acres/mile treated) at a rate of $37,200/acre.
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	74.00					74	Cost based on riparian restoration monitoring at a rate of $73,793/project.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action steps. Increase LWD frequency and habitat complexity addressed in previous action steps.
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action steps.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	115.00					115	Cost based on fish/habitat restoration at a rate of $114,861/project.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	26.00					26	Cost based to treat 1 mile (assume 1 project per mile in 25% high IP with a minimum of 1 mile) at a rate of $26,000/mile. Cost could be significantly high if use ELJ at a rate of $104,000/ELJ
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 25% high IP) at a rate of $26,000/mile. This action should be in conjunction with above action steps.
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						0	Cost likely accounted for in above action steps.
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	59.00	59.00				118	Cost based on treating 1 mile (assume 1 project/mile in 15% high IP with 80 acres/mile) at a rate of $1468/acre.
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	166.00	166.00				332	Cost based on treating 0.2 miles (assume 1 project/mile in 5% high IP with 80 acres/mile) at a rate of $20,719/acre.
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, TNC						0	Fair market value, land turnover, and easement size will determine the success of this action step. Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	6					6	Cost based on treating 0.3 miles (assume 5% high IP) at a rate of $3.63/ft.
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						0	Action is considered In-Kind
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						0	This action step is a management decision.
GutC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	3.35	3.35				7	Cost for sediment assessment for 133 acres (assume 10% of total acres) at a rate of $12.62/acre.
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						TBD	Cost will be associated with appropriate actions once plan has been developed.
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							Cost accounted for in above action step.
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							Cost accounted for in action step 7.1.2.3
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						0	Cost are accounted for through implementation of other action steps to reduce sedimentation into instream habitat.
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						0	Action is considered In-Kind
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						0	Cost accounted for in HABITAT COMPLEXITY
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							TBD	Costs will likely rely on standard population status and trends monitoring which are covered in the Monitoring Chapter.
GutC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW, NMFS						0	Costs for adult spawning ground surveys are covered in the Monitoring Chapter.
GutC-NCSW-11.1.1.3	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, NMFS						0	Costs for juvenile surveys are covered in the Monitoring Chapter.
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										

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	2.00					2	Cost based on treating 1 mile at a rate of $2,000/mile.
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	414.50	414.50	414.50	414.50		1,658	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP with a minimum of 1 and 20 acres/mile) at a rate of $20,719/acre.
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						0	Cost accounted for in above action step.
GutC-NCSW-18.1.2.3	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	20.00					20	Cost based on treating 1 mile (assume 1 project/mile in 5% high IP) at a rate of $3.63/ft.
GutC-NCSW-18.1.2.4	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						0	Action is considered In-Kind
GutC-NCSW-18.1.2.5	Action Step	Livestock	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS						TBD	TBD, cost based on amount of surface water diversions in place, need for livestock water, and landowner participation.
GutC-NCSW-18.1.2.6	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						TBD	Cost difficult to determine due to fair market value and landowner participation. Several programs currently in place provide incentives through other mechanisms.
GutC-NCSW-18.1.2.7	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB						TBD	Cost based on number and type of stream crossings needed.
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						0	Action is considered In-Kind
GutC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	2	10	CDFW						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
GutC-NCSW-19.1.1.5	Action Step	Logging	Avoid new road construction in riparian zones (< 100 feet).	2	10	CalFire, Humboldt County						0	Action is considered In-Kind
GutC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)										

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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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	5.50					6	Cost based on road inventory of 5.7 miles at a rate of $957/mile.
GutC-NCSW-23.1.1.2	Action Step	Roads/Railroads	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	10	CalFire, Humboldt County						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action step.

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						TBD	
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						TBD	Sites need to be identified to determine the accurate cost to implement this action step.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	SWRCB						0	Action is considered In-Kind
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	3.00					3	Cost base on a minimum of 3 stream flow gauges estimated cost of $1000/gauge. Cost does not include setup hardware or maintenance.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	744.00					744	Cost based on treating 1 mile (assume 1 project/mile in 25% high IPwith 20 acres/mile treated) at a rate of $37,200/acre.
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	115.00					115	Cost based on fish/habitat restoration monitoring estimated at a rate of $114,861/project.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action step
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action step.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	115.00					115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project. This action step could be coordinated with floodplain connectivity actions to reduce cost and redundancy.
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action step.
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						0	Action is considered In-Kind
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile. Cost for ELJ estimated at $104,000/ELJ.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
OiC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50%high IP) at a rate of $26,000/mile. This action step should be coordinated with above action step to reduce redundancy.
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						0	Cost accounted for in above action step.
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	13.50	13.50				27	Cost based on treating 0.9 miles (assume 1 project/mile in 15% high IP with 20 acres/mile treated) at a rate of $1468/acre.
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	62.00	62.00				124	Cost based on treating 0.3 (assume 5% high IP with 20 acres/mile treated) at a rate of $20,719/acre.
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, TNC						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in action step below.
OiC-NCSW-7.1.2.5	Action Step	Riparian	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS						TBD	Cost for number of water sources unknown. Estimate for off-channel water sources is $5,000/site.
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action step. This recommendation requires a change in management of forested lands.
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										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	1.70					2	Cost based on assessing 133 acres (assume 25% of total acres) at a rate of $12.62/acre.
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						TBD	Cost based on amount of slides and gullies needing treatment. Above action step should identify number, magnitude, and potential alternatives to address sources of sediment. Estimate for landslide restoration is $3,064/acre.
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							Cost will vary depending on extent and method of mapping and remediation. Additional sediment assessment directed at road design estimated to cost $957/mile.
OiC-NCSW-8.1.1.4	Action Step	Sediment	Address high and medium priority sediment delivery sites	2	10	CalFire, Farm Bureau, NCRWQB, NRCS						TBD	Cost based on sediment assessment action above to rank high and medium priority sites.
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	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NRCS	5.80					6	Cost based on treating 0.3 miles (assume 5% high IP) at a rate of $3.63/ft.
OiC-NCSW-8.1.2.2	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						0	Action is considered In-Kind
OiC-NCSW-8.1.2.3	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	3	5	CalFire, CDFW, Trout Unlimited	78.00					78	Cost based on treating 3 miles (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile.
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						0	Costs for adult spawning ground surveys are covered in the Monitoring Chapter.
OiC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, Trout Unlimited						0	Costs for juvenile surveys are covered in the Monitoring Chapter.
OiC-NCSW-11.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**										
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	2.00					2	Cost based on treating 1 mile at a rate of $2,000/mile.
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)										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	828	828				1,656	Cost based on treating 1 mile (assume 1 project/mile in 5% in high IP with 80 acres/mile) at a rate of $20,719/acre)
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	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.
OiC-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						TBD	Cost based on amount of exclusion fencing and off-stream water development needed. Estimate for excluison fencing is $3.63/ft and off-stream water source is $5,000/station.
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						0	Action is considered In-Kind
OiC-NCSW-18.1.2.4	Action Step	Livestock	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS						TBD	Cost based on number of water sources to be relocated. Estimate for off-stream water is $5,000/site.
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						TBD	Cost based on incentives to provide and landowner participation. Currently, incentives programs exist and should be explored and expanded.
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						TBD	This action step should be combined with riparian exclusion fencing to reduce cost.
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						0	Action is considered In-Kind
OiC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.		20	CDFW						0	Action is considered In-Kind
OiC-NCSW-19.1.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	3	100	CalFire						0	Action is considered In-Kind
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						0	Action is considered In-Kind
OiC-NCSW-19.1.1.5	Action Step	Logging	Work with Calfire and CDFW therough the timber harvest permitting process to avoid new road construction in riparian zones (< 100 feet).	2	10	CalFire, CDFW						0	This recommendation should be considered standard practice. Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	5.40					5	Cost based on road inventory for 5.6 miles of road at a rate of $957/mile.
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						0	This recommendation should be considered standard practice. Action is considered In-Kind
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						TBD	Cost for amount of conditions needed to be corrected is unknown. Cost estimated at a rate of $3,260/mile for maintenance.
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						0	Cost accounted for in above action step.
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						0	Cost accounted for in above action steps.
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						0	Action is considered In-Kind

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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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in action step below.
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						TBD	Cost for number and size of spoils storage sites is variable.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
OiC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Work with CDFW and the SWRCB tp 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						0	Action is considered In-Kind
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	3.00					3	Cost based on installing 3 stream flow gauges estimated at $1000/gauge. Cost does not account for installation hardware or maintenance.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	372.00	372.00				744	Cost based on treating 1 mile (assume 1 project/mile in 25% high IP with 20 acres/mile treated) at a rate of $37,200/acre.
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	115.00					115	Cost based on fish/habitat restoration monitoring estimated at a rate of $114,861/project.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in above action step
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						0	Action is considered In-Kind
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						TBD	Cost accounted for in above action step.

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	115.00					115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project. This action step could be coordinated with floodplain connectivity actions to reduce cost and redundancy.
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						0	Action is considered In-Kind
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							Cost accounted for in above action step.
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						0	Action is considered In-Kind
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile. Cost for ELJ estimated at $104,000/ELJ.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
McNC-NCSW-6.1.4	Recovery Action	Habitat Complexity	Improve shelter										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50%high IP) at a rate of $26,000/mile. This action step should be coordinated with above action step to reduce redundancy.
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						0	Cost accounted for in above action step.
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	27.00					27	Cost based on treating 0.9 miles (assume 1 project/mile in 15% high IP with 20 acres/mile treated) at a rate of $1468/acre.
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	62.00	62.00				124	Cost based on treating 0.3 (assume 5% high IP with 20 acres/mile) at a rate of $20,719/acre.
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, TNC						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Cost accounted for in action step below.
McNC-NCSW-7.1.2.5	Action Step	Riparian	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS						TBD	Cost for number of water sources unknown. Estimate for off-channel water sources is $5,000/site.
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						0	Action is considered In-Kind
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						TBD	Cost accounted for in above action step. This recommendation requires a change in management of forested lands.
McNC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	1.70					2	Cost based on assessing 133 acres (assume 25% of total acres) at a rate of $12.62/acre.
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						TBD	Cost based on amount of slides and gullies needing treatment. Above action step should identify number, magnitude, and potential alternatives to address sources of sediment. Estimate for landslide restoration is $3,064/acre.
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						TBD	Cost will vary depending on extent and method of mapping and remediation. Additional sediment assessment directed at road design estimated to cost $957/mile.
McNC-NCSW-8.1.1.4	Action Step	Sediment	Address high and medium priority sediment delivery sites	2	10	CalFire, Farm Bureau, NCRWQB, NRCS						TBD	Cost will vary depending on extent and method of remediation.
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	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	5	Farm Bureau, NRCS	5.80					6	Cost based on treating 0.3 miles (assume 5% high IP) at a rate of $3.63/ft.
McNC-NCSW-8.1.2.2	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						0	Action is considered In-Kind
McNC-NCSW-8.1.2.3	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	3	5	CalFire, CDFW, Trout Unlimited	78.00					78	Cost based on treating 3 miles (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile.
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						0	Costs for adult spawning ground surveys are covered in the Monitoring Chapter.
McNC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, NMFS						0	Costs for juvenile surveys are covered in the Monitoring Chapter.
McNC-NCSW-11.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**										
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	2.00					2	Cost based on treating 1 mile at a rate of $2,000/mile.

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
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	207	207				414	Cost based on treating 1 mile (assume 1 project/mile in 5% in high IP with 20 acres/mile treated) at a rate of $20,719/acre)
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	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.
McNC-NCSW-18.1.2.3	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						TBD	Cost based on amount of exclusion fencing and off-stream water development needed. Estimate for excluison fencing is $3.63/ft and off-stream water source is $5,000/station.
McNC-NCSW-18.1.2.4	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						0	Action is considered In-Kind
McNC-NCSW-18.1.2.5	Action Step	Livestock	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS						TBD	Cost based on number of water sources to be relocated. Estimate for off-stream water is $5,000/site.
McNC-NCSW-18.1.2.6	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						TBD	Cost based on incentives to provide and landowner participation. Currently, incentives programs exist and should be explored and expanded.
McNC-NCSW-18.1.2.7	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB						TBD	This action step should be combined with riparian exclusion fencing to reduce cost.
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						0	Action is considered In-Kind
McNC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	3	20	CDFW						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
McNC-NCSW-19.1.1.5	Action Step	Logging	Work with CalFire through the timber harvest permitting process to avoid new road construction in riparian zones (< 100 feet).	2	10	CalFire						0	This recommendation should be considered standard practice. Action is considered In-Kind
McNC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	5.40					5	Cost based on road inventory for 5.6 miles of road at a rate of $957/mile.
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						0	This recommendation should be considered standard practice. Action is considered In-Kind
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						TBD	Cost for amount of conditions needed to be corrected is unknown. Cost estimated at a rate of $3,260/mile for maintenance.
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						0	Cost accounted for in above action step.

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Cost likely accounted for in above action steps.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						TBD	Cost will vary with level of detail and extent of plan.
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						TBD	Cost for number and size of spoils storage sites is variable.
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						0	Action is considered In-Kind
McNC-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Work with the SWRCB to ensure that nsure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	SWRCB						0	Action is considered In-Kind
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	3.00					3	Cost based on installing 3 stream flow gauges estimated at $1000/gauge. Cost does not account for installation hardware or maintenance.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	6.50	6.50				13	Cost based on treating 0.5 miles (assume 1 project/mile in 25% high IP) at a rate of $26,000/mile.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	104.00	104.00				208	Cost based on treating 0.5 miles (assume 1 project/mile in 50%high IP with 20 acres/mile treated) at a rate of $20,719/acre.
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						0	Cost accounted for in above action step.
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	1.50	1.50				3	Cost based for a minimum of 3 signs estimated at $1,000/sign.
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	0.38					0	Cost based on road inventory of 0.4 miles of road at a rate of $957/mile.
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						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action is considered In-Kind
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	574	574				1,148	Cost based on road inventory of 1.2 miles of road at a rate of $957/mile.
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						TBD	Cost based on amount of road network to hydrologically disconnect.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						TBD	Cost based on amount of spoils storage sites. Cost accounted for in above action step for road inventory.
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						0	Cost accounted for in road inventory.
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						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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 a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	5	BLM	115.00					115	Cost based on developing a fish/habitat restoration assessment at a rate of $114,861/project. Additional parameters will likely increase cost of the assessment.
BigC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement tot Large Wood Recruitment plan to address areas with low complexity.	2	5	BLM						TBD	Costs will be based on the conclusions of the Plan to be developed, and will vary with extent and method of implementation.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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						TBD	TBD, cost based on amount of riparian restoration projects. Cost estimated for 5% high IP at a rate of $20,719/acre.
BigC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										
BigC-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						TBD	This recommendation should be in concert with above action step.
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	10.00					10	Cost based on supplying 10 signs at rate of $1,000/sign.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	115.00					115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
BigFC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement tot Large Wood Recruitment plan to address areas with low complexity.	2	5	BLM						TBD	Costs will be based on the conclusions of the Plan to be developed, and will vary with extent and method of implementation.
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										Action is considered In-Kind
BigFC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	50	BLM, CDFW, CDFW Law Enforcement						0	Action is considered In-Kind
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						0	
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)										TBD, cost based on amount of riparian restoration projects. Cost estimated for 5% high IP at a rate of $20,719/acre.
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						TBD	
BigFC-NCSW-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										This recommendation should be coordinated with above action step. Action is considered In-Kind
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						0	Action is considered In-Kind
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)										Cost based on 10 signs at a rate of $1,000/sign.
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	5.00	5.00				10	

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	6.50	6.50				13	Cost based on treating 0.5 miles (assume 1 project/mile in 25% high IP) at a rate of $26,000/mile.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	104.00	104.00				208	Cost based on treating 0.5 miles (assume 1 project/mile in 50% high IP with 20 acres/mile treated) at a rate of $20,719/acre.
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						0	Cost accounted for in above action step.
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	1.50	1.50				3	Cost based on placing a minimum of 3 signs at a estimated cost of $1000/sign.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	32.50	32.50				65	Cost based on stream flow/precipitation monitoring at a rate of $65,084/project.
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						0	Action is considered In-Kind
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	663					663	Cost based on dam removal estimated at a cost of $663,028/project.
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	38.00	38.00				76	Cost based on annual average spawner survey cost for northern central diversity stratum estimated at $75,870.
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	231.00					231	Cost based on replacing a culvert at a rate of $230,411.
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	115.00					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
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						0	Action is considered In-Kind
TGC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools.										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action is considered In-Kind
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile
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						0	Action is considered In-Kind
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile. This action step should be coordinated with other action steps to improve habitat conditions.
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						0	Cost accounted for in above action step.
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)										
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						TBD	Cost based on length of trails in the watershed. Cost anticipated to be significantly less than cost of decommissioning a road, estimated at $12,000/mile.
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	13.50	13.50				27	Cost based on road inventory of 21 miles of road network at a rate of $957/mile and erosion assessment of 25% of total watershed acres at a rate of $12.62/acre.
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	0.60	0.60				1	Cost based erosion assessment for 5% of total watershed acres at a rate of $12.62/acre.
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						TBD	Erosion assessment will identify high and medium priority sites.
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						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	0.17					0	Cost based on spawning gravel supplementation in 0.5 miles (assume 1 project/mile in 25% high IP with 10 cu yds./project) at a rate of $32.94/cu. yd.
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile.
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	115.00	115.00				230	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
TGC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic surveys of adult abundance.	3	10	CDFW						0	Costs for adult spawning ground surveys are covered in the Monitoring Chapter.
TGC-NCSW-11.1.1.3	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	5	CDFW						0	Costs for juvenile surveys are covered in the Monitoring Chapter.
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						0	Costs for smolt out-migration monitoring are covered in the Monitoring Chapter.
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	State Water Resources Control Board						0	Action is considered In-Kind
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	3.00					3	Cost based on a minimum of 3 stream flow gauges estimated at $1000/gauge. Cost does not account for data management or maintenance.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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	115.00					115	Cost based for fish/habitat restoration assessment at a rate of $114,861/project.
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						0	Action in considered In-Kind
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	372.00	372.00				744	Cost based to treat 1 mile (assume 1 project/mile in 25% high IP with 20 acres/mile treated at a rate of $37,200/acre)
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						0	Action in considered In-Kind
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Cost likely accounted for in above action step.
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	26.00					26	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile. This recommendation should be in conjunction with other action steps to increase habitat complexity.
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	59.00	59.00				118	Cost based to treat 1 mile (assume 1 project/mile in 15% high IP with 80 acres/mile) at a rate of $1,468/acre.
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	207	207				414	Cost based on treating 1 mile (assume 1 project/mile in 5% high IP with 20 acres/mile treated) at a rate of $20,719/acre.
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, TNC						TBD	TBD, cost based on amount of habitat needed to be purchased, fair market value, and land turnover.
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						0	Action in considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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						0	Action in considered In-Kind
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						0	Cost accounted for in above action step for LIVESTOCK.
JacAC-NCSW-7.1.2.5	Action Step	Riparian	Locate water sources away from riparian areas.	2	5	Farm Bureau, NCRWQB, NRCS						0	Cost accounted for in above action LIVESTOCK.
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						0	Action in considered In-Kind
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						0	Cost associated with management actions, such as timber harvest permitting and review. Action in considered In-Kind
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						0	Costs for adult spawning ground surveys are covered in the Monitoring Chapter.
JacAC-NCSW-11.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed.	3	10	CDFW, NMFS						0	Costs for juvenile surveys are covered in the Monitoring Chapter.
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	1.00	1.00				2	Cost based on treating 1 mile at a rate of $2,000/mile.
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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)										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	20.72					21	Cost based on treating 1 mile (assume 1 project/mile in 5% high IP with 80 acres/mile) at a rate of $20,719/acre.
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						0	Cost accounted for in above action step
JacAC-NCSW-18.1.2.3	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						TBD	Cost based on amount of stream miles needing to be fenced from livestock. Estimate for exclusion fencing is $3.63/ft.
JacAC-NCSW-18.1.2.4	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						0	Action in considered In-Kind
JacAC-NCSW-18.1.2.5	Action Step	Livestock	Locate water sources away from riparian areas.	2	10	Farm Bureau, NCRWQB, NRCS						TBD	Cost based on amount of off-channel water sources needed. Estimate for off-channel water sources is $5,000/site.
JacAC-NCSW-18.1.2.6	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						TBD	Cost based on amount of incentive to provide, willingness of participants, and amount of fencing needed. Currently, existing incentive programs are in place and should be explored and expanded. Cost likely accounted for in above action step.
JacAC-NCSW-18.1.2.7	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	5	CDFW, Farm Bureau, NCRWQB						TBD	Cost based on amount of crossings needed. Cost savings should be high priority by incorporating this action step with riparian exclusion fencing.
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						0	Action in considered In-Kind
JacAC-NCSW-19.1.1.2	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	2	10	CDFW						0	Action in considered In-Kind
JacAC-NCSW-19.1.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	3	50	CalFire						0	Action in considered In-Kind
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						0	Action in considered In-Kind
JacAC-NCSW-19.1.1.5	Action Step	Logging	Work with CalFire and humboldt County to avoid permitting new road construction in riparian zones (< 100 feet).	2	10	CalFire, Himboldt County						0	This recommendation should be standard practice. Action in considered In-Kind
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						0	Action in considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Action in considered In-Kind
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						0	This recommendation should be standard practice. Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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	5.00					5	Cost based on providing 5 signs at a rate of $1000/sign.
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	11.00					11	Cost based on road inventory of 11 miles of road at a rate of $957/mile.
JacAC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Work with CalFire and the County to avoid 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						0	Action in considered In-Kind
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						0	Action in considered In-Kind

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						0	Cost accounted for in above action step.
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						0	Cost would be likely be minimal part of road maintenance. Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
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						0	cost accounted for in development of a road inventory.
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						0	Action in considered In-Kind
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						0	Action in considered In-Kind
JacAC-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Work with the SWRCB to ensure that nsure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	SWRCB						0	Action in considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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						3	Cost based on deploying 3 stream flow gauges at a rate of $1000/gauge. Cost does not account for data management or maintenance.

NC Steelhead DPS Rapid Assessment Profile: Northern Coastal Stratum Populations (Lower Eel River Tributaries and Howe Creek)

Lower Eel River Tributaries

- Role within DPS: Dependent Population
- Spawner Abundance Target: 999-2,001 adults
- Current Intrinsic Potential: 166.9 IP-km

Howe Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: 81-165 adults
- Current Intrinsic Potential: 13.9 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/).

Steelhead 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 (CEMAR 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 (US EPA 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 (2012) 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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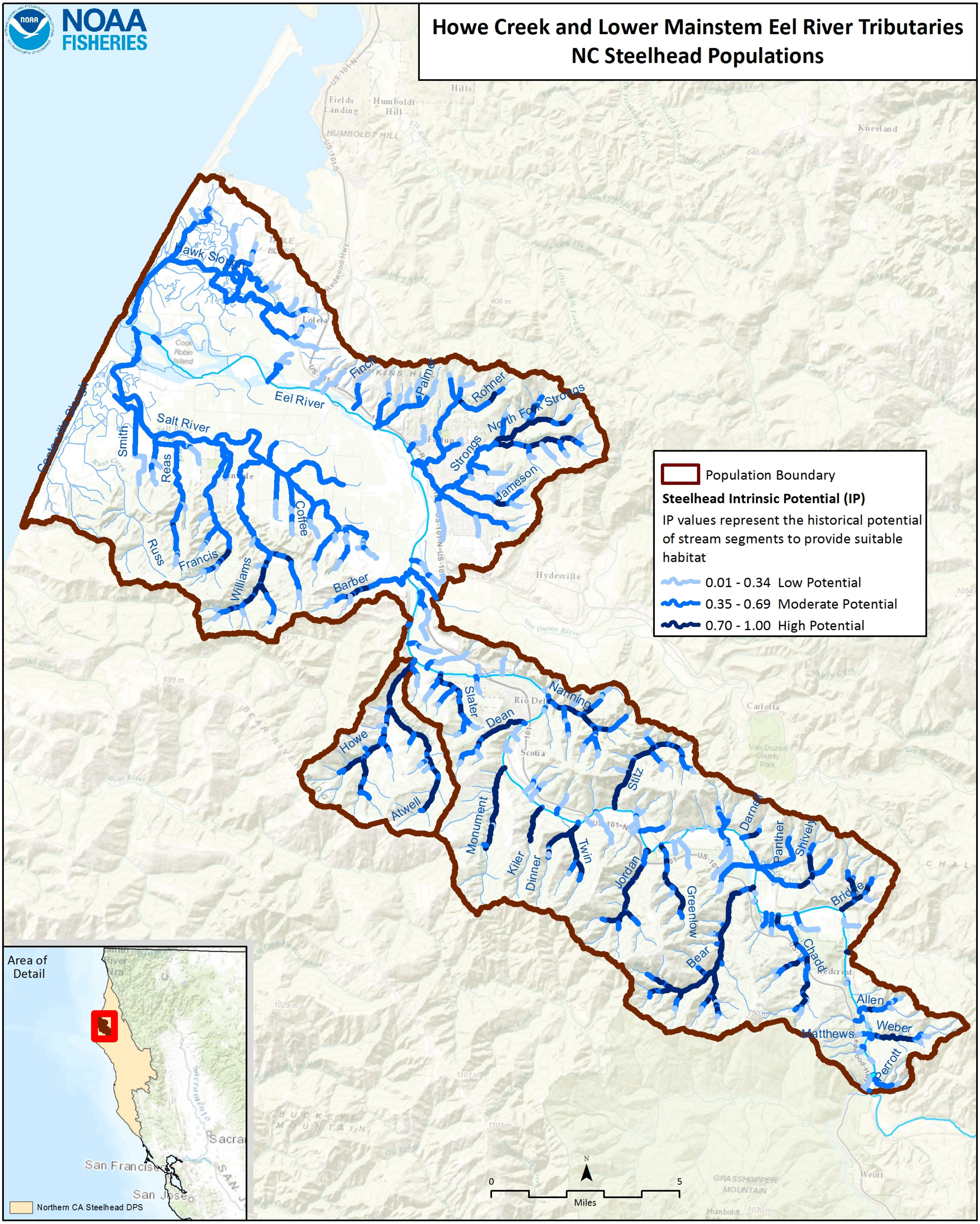
Howe Creek and Lower Mainstem Eel River Tributaries NC Steelhead Populations



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		**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	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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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.	2	25	CDFW, Corps, NOAA RC, Private Landowners, RWQCB						TBD	Cost based on amount of habitat to acquire to restore estuarine conditions. Cost based on fair market value and landowner participation.
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						0	Action is considered In-Kind
LMER-NCSW-1.1.1.3	Action Step	Estuary	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	225.00					225	Cost based on escapement and juvenile migration monitoring at a rate of $36,379 and 188,264/project, respectively.
LMER-NCSW-1.1.1.4	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.	2	10	CDFW, Humboldt County, NMFS, NOAA RC, Tribes						0	Action is considered In-Kind
LMER-NCSW-1.1.1.5	Action Step	Estuary	Encourage and partner with Fortuna Creeks Project's urban stream clean-up, habitat restoration and monitoring (CDFW-CWPAP, 2013).	2		Fortuna Creek Project						0	Action is considered In-Kind
LMER-NCSW-1.1.1.6	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).	2	5	CDFW, Humboldt County, Local Agencies	115.00					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
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.	2	10	CDFW, Corps, Farm Bureau, Humboldt County, NOAA RC, Private Landowners, RWQCB						0	Cost accounted for in other action steps: CHANNEL MODIFICIATION.
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).	2	25	CDFW, NMFS, NOAA RC, Private Landowners	7,833	7,833	7,833	7,833	7,833	39,163	Cost based on treating 10% total estuarine habitat at a rate of $41,000/acre.
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						0	Cost accounted for in above action steps.
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).	2	10	CDFW, Humboldt County	1,220	1,220				2,439	Cost based on erosion assessment of 10% of total watershed acres. Combined acreage of Middle and Upper Subbasins equals 1,932,960 acres.
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						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	20.00					20	Cost based on installing continuous water quality monitoring stations at a rate of $5,000/station. Cost does not account for data management or maintenance.
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	77.00	77.00				154	Cost based on treating 8 miles (assume 1 project/mile in 5% high IP) at a rate of 3.63/ft.
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	214.00					214	Cost based on wetland restoration at a rate of $213,307/project.
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						0	Action is considered In-Kind, as programs are developed as part of normal agency operations.
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	1,740	1,740				3,479	Cost based on treating 133 miles (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile.
LMER-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LMER-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
LMER-NCSW-5.1.1.1	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	71.00	71.00				142	Cost based on removal of tidegates at a rate of $141,284/tidegate.
LMER-NCSW-5.1.1.2	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	3,108	622				3,729	Cost based on providing passage at 7 crossings (assume partial barrier) at a rate of $532,706/barrier.
LMER-NCSW-5.1.1.3	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 Consultants, Private Landowners	112.50	112.50				225	Cost based on adult escapement and juvenile migration model at a rate of $36,709 and $188,264/project. Cost may be higher if more assessments are needed.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
LMER-NCSW-5.1.1.4	Action Step	Passage	Improve passage at Stitz, Darnel, Panther, Allen, and Weber creeks.	2	5	Caltrans, CDFW, Humboldt Redwood Company, NOAA RC	500.00					500	Rough estimate of 100,000 for each site.
LMER-NCSW-5.1.1.5	Action Step	Passage	Implement passage improvements on Chadd Creek at Highway 254 and Holmes Flat Road.	2	1	Caltrans, CDFW, NOAA RC	200					200	Rough estimate of 100,000 for each site.
LMER-NCSW-5.1.1.6	Action Step	Passage	Evaluate and prescribe solution for perched sediment at the mouth of Dean Creek to improve fish passage.	3	1	CDFW, NOAA RC, Private Consultants, Private Landowners	50.00					50	
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						0	Action is considered In-Kind
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						TBD	Costs will vary depending on extent and methods applied.
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						TBD	Costs will vary depending on methods implemented and extent of rehabilitation
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	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.
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						0	Action is considered In-Kind
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 Consultants, Private Landowners	50.00					50	Estimate 50k per assessment.
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						TBD	Costs will vary depending on methods implemented and extent of rehabilitation

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	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
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						TBD	
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						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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		City of Ferndale, RWQCB						0	Action is considered In-Kind
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						0	Action is considered In-Kind
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	250.00	250.00				500	
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	100.00					100	
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						TBD	Cost based on number and type of tidegates to remove or modify. Cost to replace tidegates estimated at $141,284/tidegate.
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	75.00					75	
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	9,791	9,791	9,791	9,791		39,164	Cost based on treating 10% of total estuarine habitat at a rate of $41,000/acre.

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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	50.00	50.00				100	
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						0	Action is considered In-Kind
LMER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers.	2	5	CDFW, NMFS						0	Action is considered In-Kind
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	25.00	25.00				50	
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.	2	20	Humboldt County, Private Landowners, RWQCB						0	Action is considered In-Kind
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 throught the timber harvest permitting process to minimize timber harvest actions on unstable soils.	2	25	CalFire, CDFW, NMFS, RWQCB						0	Action is considered In-Kind

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	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 Consultants, Private Landowners	50.00					50	Most of thes 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	100.00	100.00				200	
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	74.00					74	Cost based on riparian restoration model at a rate of $73,793/project.
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						0	Action is considered In-Kind
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						TBD	Most of thes 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										

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	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
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 Consultants, Private Landowners, RWQCB	50.00					50	Estimate 50k per assessment.
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						0	Action is considered In-Kind
HowC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulation Section 8.00 (a) (1-3) low flow restrictions for the Eel and Van Duzen rivers.	2	5	CDFW, NMFS						0	Action is considered In-Kind
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.	2		CDFW, Humboldt County, Private Landowners						0	Action is considered In-Kind
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	25.00	25.00				50	
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 proces to minimize timber harvest actions on unstable soils in the headwater areas of Howe Creek and its tributaries.	2	25	CalFire, CDFW, NMFS						0	Action is considered In-Kind