North Mountain Interior Diversity Stratum

This stratum includes populations of winter steelhead that spawn in watersheds that drain relatively high elevation mountains in the Klamath Mountains ecoregion, many of which attain sufficiently high elevations for snowmelt to contribute significantly to the annual hydrograph. Most of these watersheds lie north of the mainstem Eel River. Included in this stratum are larger and minor mainstem tributaries of the Eel River whose watersheds include relatively high elevation mountains.

The populations that have been selected for recovery scenarios are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum. Although Redwood Creek and Mad River cross two diversity strata and were broken into an upper and lower populations, there was only one profile, results and recovery actions developed for the upper and lower populations. These are found in the Northern Coastal Diversity Stratum section of this Recovery Plan. Dobbyn Creek is found in the Rapid Assessment that was done for the Lower Interior/North Mountain Interior Diversity Strata and located in the North Mountain Interior Diversity section of this Recovery Plan.

- Larabee Creek
- Mad River (Upper)* See Northern Coastal Diversity Stratum
- Middle Fork Eel River
- North Fork Eel River
- Redwood Creek (Humboldt Co.) (Upper)* See Northern Coastal Diversity Stratum
- Upper Mainstem Eel River
- Van Duzen River
- Lower Interior/North Mountain Interior Rapid Assessment
    - Dobbyn Creek (See Lower Interior Diversity Stratum)

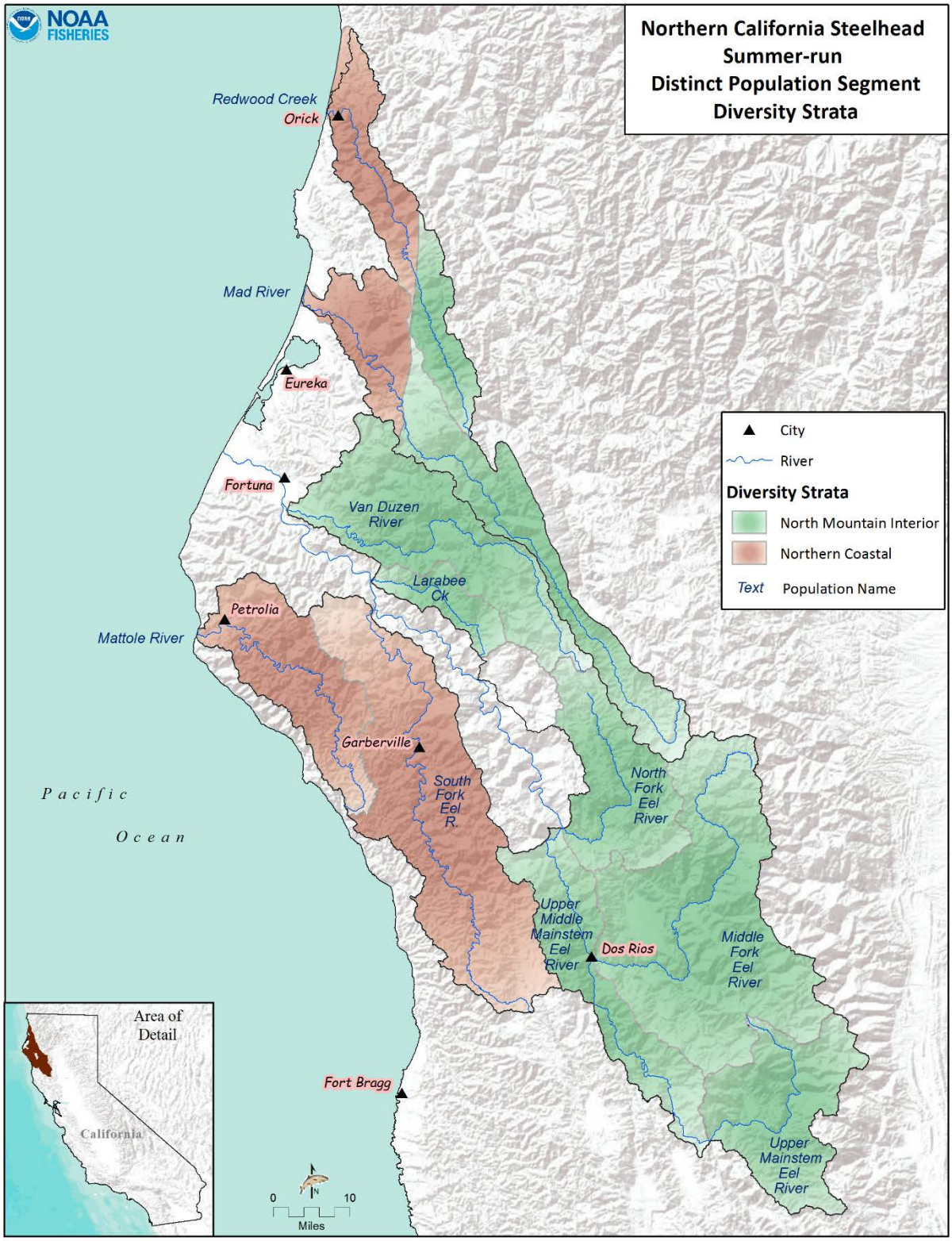
NC steelhead North Mountain Interior Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting. Redwood Creek and Mad River cross two diversity strata and were broken into an upper and lower to reflect this.

Diversity Stratum	NC steelhead Populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
North Mountain Interior	Dobbyn Creek	I	Supporting	49.1	6-12	293-587
	Larabee Creek	I	Essential	88.4	29.9	2,600
	Mad River (Upper)*	I	Essential	305.6	20.0	6,100
	Middle Fork Eel River	I	Essential	483.7	20.0	9,700
	North Fork Eel River	I	Essential	318.2	20.0	6,400
	Redwood Creek (Humboldt Co) (Upper)*	I	Essential	87.2	30.1	2,600
	Upper Mainstem Eel River	I	Essential	209.2	20.0	4,200
	Van Duzen River	I	Essential	317.4	20.0	6,300
	North Mountain Interior Diversity Stratum Recovery Target					**37,900**

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

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

NC Winter-Run Steelhead North Mountain Interior Diversity Stratum



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

Larabee Creek Population

NC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 2,600 adults
- Current Intrinsic Population: 86.6 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

Historical steelhead abundance estimates for Larabee Creek are lacking, but insight as to how prolific the anadromous salmonid runs were at the start of European settlement within the watershed may be gleaned from early fishing records at the mouth of the Eel River (Yoshiyama and Moyle 2010). Given the amount of habitat available historically within Larabee Creek, steelhead runs likely numbered in the thousands prior to the habitat degradation and overfishing that began during the latter 19th century.

The Larabee Creek adult steelhead run was estimated at 2,000 adult fish during 1978 (Becker and Reining 2009). Steelhead are distributed throughout the population area up to natural barriers to anadromy (PALCO 2007). A long-standing road-crossing barrier exists on Chris Creek, the lowermost tributary to Larabee Creek.

History of Land Use

Historically, the Larabee Creek watershed contained primarily late-seral redwood/Douglas-fir (coniferous) forests, with limited open oak woodland/prairies farther inland at higher elevations (PALCO 2007). The first logging activities occurred in the 1900s and 1910s in the floodplain areas of lower Larabee Creek where timber was large and easily accessible (PALCO 2007). More than 60 percent of the lower Larabee Creek area, including significant portions of the Chris, Carson, Smith, Balcom, Dauphiny, Scott, and Arnold creek drainages, was logged by the end of the 1920s (PALCO 2007). Following the initial logging, technological developments after World War II enabled logging and road building in steeper, more landslide prone areas, which caused excessive sediment delivery to streams. Massive erosion and instream sedimentation occurred following large floods in 1955 and 1964, filling in pools and widening stream channels. The remainder of the old-growth timber in the Larabee Creek watershed was harvested by the 1980s,

and second-growth logging activities have occurred since then (PALCO 2007). After settlement by ranchers in the early 1900s, the lower Larabee Creek area was burned repeatedly for cattle grazing (PALCO 2007).

Current Resources and Land Management

Ninety-nine percent of the Larabee Creek watershed is under private ownership, with much of the lower one-third of the watershed actively managed for timber production by the Humboldt Redwood Company (HRC; formerly PALCO). Timber holdings owned by HRC are managed according a Habitat Conservation Plan (HCP) that seeks to minimize adverse effects to aquatic and terrestrial habitat during timberland operations. The goals of the HRC HCP include trending towards properly functioning aquatic conditions and reducing sediment input by upgrading 1,500 miles of roads on their timberlands (HRC 2012). Other land uses occurring within the Larabee Creek watershed include rural residential, agriculture, and livestock grazing. There are several active watershed groups in the area: the Eel River Watershed Improvement Group, Friends of the Eel River, and the Eel River Restoration Project. The following are pertinent reports or plans for Larabee Creek:

- Humboldt Redwood Company HCP (HRC 2012);
- HRC Watershed Analyses for: Lower Eel/Eel Delta and Upper Eel (PALCO 2007);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997); and
- Lower Eel River Total Maximum Daily Loads for Temperature and Sediment (USEPA 2007).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process steelhead: shelter rating, canopy cover, streamside road density, aquatic invertebrates, estuary quality and extent, water temperature, timber harvest, and riparian tree diameter. Recovery strategies will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

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

Population and Habitat Conditions

Viability: Density, Abundance, and Spatial Structure

Based on population abundance and trend data from other Eel River sub-basins (e.g., SF Eel, Upper Eel), the abundance of steelhead in Larabee Creek is likely well below low-risk abundance targets and is therefore likely limiting their ability to successfully reproduce and increase in abundance (e.g., depensatory effects). However, habitat conditions are improving in many areas and are currently adequate for steelhead to successfully complete their freshwater life history. Restoration of degraded habitat, combined with improved land management, should allow the Larabee Creek steelhead population to increase in abundance.

Estuary: Quality and Extent

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

Habitat Complexity: Large Wood and Shelter

Habitat Complexity: Shelter conditions are rated Poor for summer rearing juveniles and large wood frequency is rated Fair for all life stages. PALCO (2007) determined tree size resulting from young forest stands is currently the limiting factor for recruitment of functional large wood in the management unit that includes lower Larabee Creek. However, PALCO (2007) concluded that nearly 90 percent of the riparian forests in the management unit will meet or exceed riparian composition goals within 40 years.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediments conditions have an overall Fair rating for adults, eggs, and summer and winter rearing juvenile steelhead. Embeddedness levels are high within Larabee Creek tributaries and the upper mainstem (PALCO 2007). Suitable spawning gravel exists in some areas within the watershed but other areas are still impaired (*e.g.*, excess fine sediments) from past land use. Impaired gravel quality may reduce macro-invertebrate production that supports rearing salmonids. Threats contributing to this condition include Logging and Wood Harvesting and Roads and Railroads.

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

Pool complexity and pool: riffle ratios are rated Fair for adults and summer and winter rearing salmonids. PALCO (2007) determined pool complexity and pool: riffle ratio metrics for Larabee Creek mostly met properly functioning conditions, although distinct differences were observed between streams sampled in the lower watershed (Wildcat geology) versus upper watershed sites (Yager geology). Average pool depths are typically greater than 3 feet in the mainstem; however,

tributary pools are shallower. For instance, average pool depth in Larabee Creek tributaries was 1.5 feet (PALCO 2007). These conditions primarily affect summer rearing juvenile steelhead. Due to contribution of fine sediment, the primary threats contributing to this condition are Logging and Wood Harvesting and Roads and Railroads.

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian Vegetation conditions have an overall Fair rating for the watershed processes in the Larabee Creek population area. Where data exist, streamside canopy cover shows a range of conditions, with some good to very good conditions (70 percent to 100 percent shade) in tributaries, and poor cover and shade conditions in the mainstem channel. For instance, over half of the channel length of lower Larabee Creek has less than 20 percent canopy cover. Even where streamside canopy cover is good, such as in first and second order channels of many Larabee Creek tributaries, riparian areas consist predominantly of hardwood species and immature conifers that are not yet of size to effectively function as LWD (PALCO 2007). The primary threat contributing to this condition is Logging and Wood Harvesting.

Sediment Transport: Road Density

Sediment transport by road density conditions have an overall Poor rating for the watershed processes in the Larabee Creek population area. The Eel River watershed is one of the most naturally erodible watersheds in the United States (Brown and Ritter 1971) because of the highly active tectonic setting, highly erodible soils in the area, and high precipitation. Anthropogenic activities in Larabee Creek such as road building have exacerbated these naturally high sediment loads (USEPA 2007). Most subwatersheds in the Larabee Creek basin exhibit road densities much higher than 3 road miles per square mile of land, with up to 7.8 road miles per square mile in the mid-Larabee subcomplex of tributaries (PALCO 2007).

Landscape Patterns: Timber Harvest

Major legacy and current landscape disturbance within Larabee Creek, primarily associated with timber harvest and associated road building results in a rating of Poor for Timber Harvest on watershed processes.

Water Quality: Temperature

High water temperatures are stressful for summer rearing steelhead. The Larabee Creek watershed is listed as impaired for elevated temperature under section 303(d) of the Clean Water Act. Summer water temperatures in mainstem Larabee Creek approach lethal levels (USEPA 2007), which severely limits the amount of habitat available to rearing steelhead. Solar warming of pools occurs in the lower mainstem due to poor riparian cover and high sediment loads that decrease pool depth. As mentioned earlier, many Larabee Creek tributaries exhibit suitable levels

of canopy cover, and therefore have water temperatures that support juvenile steelhead rearing (PALCO 2007).

Very Good or Good Current Conditions

Floodplain Connectivity condition is rated Good for juveniles, smolts, and adults. Floodplains in Larabee Creek were determined to be fully functional (PALCO 2007), but excessive sediment loads and dysfunctional riparian processes (*i.e.,* poor LWD recruitment) in the mainstem Eel River below the confluence with Larabee Creek, and levees in the Eel River estuary limit floodplain access for Larabee Creek salmonids during outmigration. Barriers to fish passage do not present a major impediment to recovery of steelhead in Larabee Creek, although a long-standing road-crossing barrier on Chris Creek and log-jams in several tributaries are believed to partially impede adult passage.

Threats

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

Population and Habitat Threats

Roads and Railroads

Roads constitute a High threat to summer rearing juvenile steelhead, and a High threat to watershed processes. Most subwatersheds in the Larabee Creek basin exhibit road densities much higher than 3 road miles per square mile of watershed, with up to 7.78 road miles per square mile in the mid-Larabee subcomplex of tributaries (PALCO 2007). Road storm proofing, reconstruction, and upgrading have occurred on a significant portion of HRC's roads (PALCO 2007) and will continue to occur under the HCP.

Logging and Wood Harvesting

Logging and Wood Harvesting is a High threat to watershed processes. Many of the changes that have occurred to instream and riparian conditions in Larabee Creek reflect legacy effects of more intensive harvest from previous decades. In the future, given the percentage of the watershed that is actively managed as timberland, and that most of the watershed has been logged in the past, continuing harvest on these areas will likely continue to affect habitat downstream by introducing more sediment than would occur naturally.

Channel Modification

Channel modification is rated as a High threat for smolts. Channel modification is not pervasive in Larabee Creek, but the Eel River estuary and mainstem have been significantly channelized by dikes and levees and subsequent filling for ranching or livestock purposes. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Disease, Predation and Competition

Competition and predation from non-native Sacramento pikeminnow (predation and competition) and California roach (competition) pose a High stress to summer rearing steelhead. These non-native species have the greatest impact in wide, low gradient mainstem reaches where degraded instream habitat and water quality conditions favor their production over indigenous steelhead and increase the risk of predation by Sacramento pikeminnow.

Fishing and Collecting

Fishing and Collecting is rated a High threat to winter adult steelhead. Although the fishery is catch-and-release only, the activity attracts hundreds, if not thousands, of anglers every season. Regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration. Currently, sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1 of each year and expires on January 31, which allows anglers to target steelhead staging in low flow conditions throughout September or after January. Adults are easy targets for both fisherman and poachers in these extremely low flows. Poor water quality in September contributes to the stress and likely results in increased hook-and-release mortalities (Clark and Gibbons 1991).

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

Low or Medium Rated Threats

Less than one percent of the Larabee Creek population area is currently used for agriculture, and residential development is sparse and low in density; therefore, these threats are a Low to

Medium threat. Although there are few diversions in the population area, any diversion or groundwater pumping in the summer exacerbates already stressful rearing conditions for steelhead, and is therefore considered Medium stress to rearing lifestages. Fuel management and fire suppression is a Medium threat because it may increase the potential for a catastrophic fire in the future, particularly in the interior portion of the watershed.

Currently, the extent of marijuana production in the Larabee Creek drainage is unknown; however it is likely to be increasing as it has in other sub-watersheds throughout the Eel River system. The potential implications of expanding marijuana production on stream flow quantity and quality and habitat availability in the Larabee Creek drainage should be assessed.

Limiting Stresses, Lifestages, and Habitats

Summer rearing steelhead productivity is likely limiting subsequent adult abundance within the Larabee Creek watershed. Inadequate stream shading, high water temperatures, impaired gravel quality (spawning and benthic food productivity), and reduced habitat complexity have reduced the quality and extent of rearing habitat.

General Recovery Strategy

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

Improve Riparian Habitat Function and Composition

Increase the quality and quantity of riparian vegetation through appropriate silvicultural prescriptions such as thinning (for release of conifers) and planting. Reestablishment of coniferous forests in the lower mainstem floodplain will improve canopy cover and instream temperatures.

Increase Habitat Complexity

Pools in Larabee Creek and mainstem Eel River are too simplified and shallow to adequately support juvenile steelhead growth and survival. Large wood, boulders, or other instream structure should be added in proximity to cool water refugia in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be re-created in the low-gradient areas of the population area, as well as the lower mainstem Eel River.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor steelhead habitat. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance which minimizes effects on salmonid habitat should be developed for building and maintenance of private roads.

Reduce Abundance of Sacramento Pikeminnow

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

Improve Passage

Assess passage at logjam barriers in tributaries and provide passage if feasible. Remove the road crossing barrier on Larabee Ranch.

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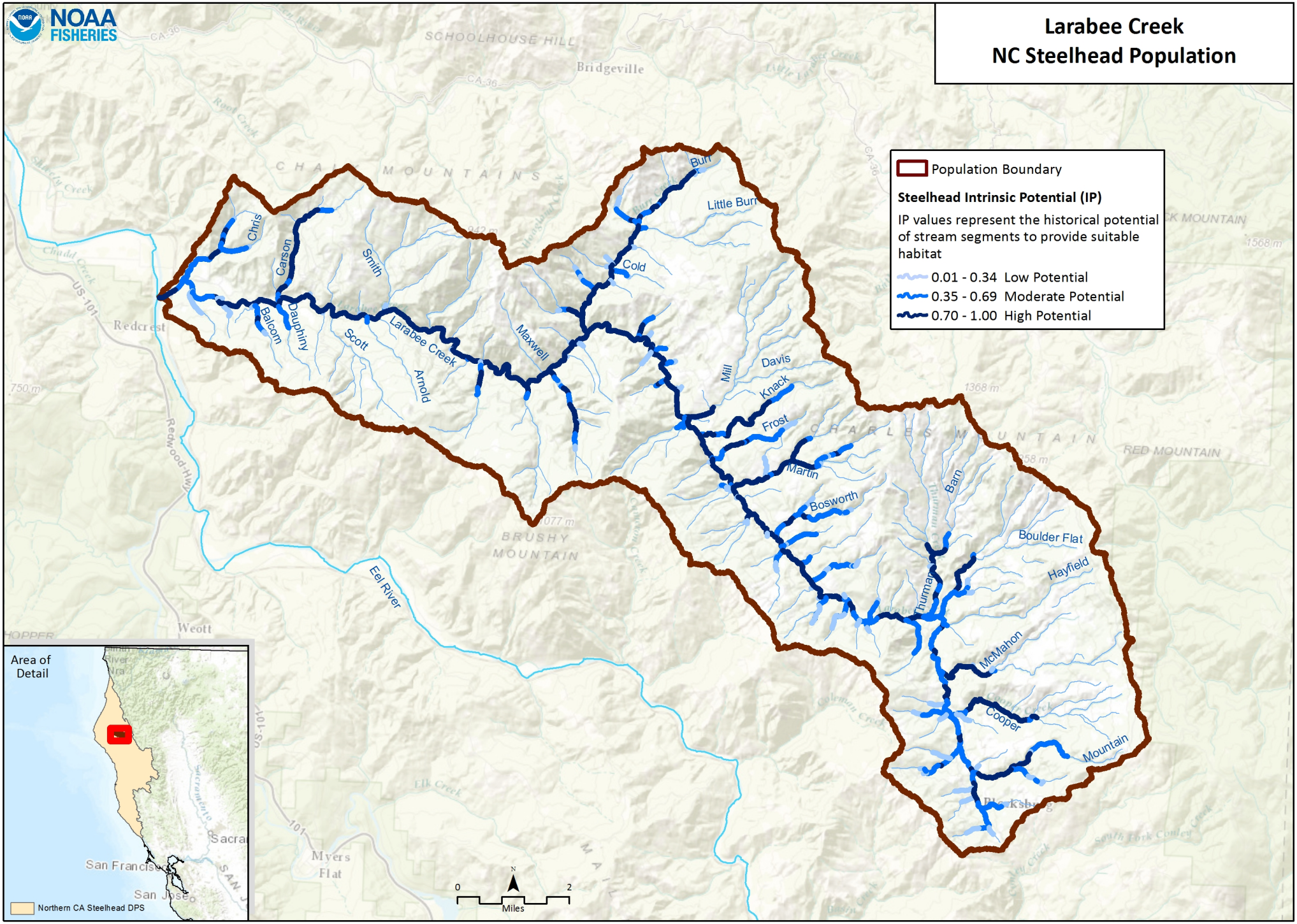
Larabee Creek
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Chris
Carson
Smith
Balcom
Dauphiny
Scott
Larabee Creek
Arnold
Maxwell
Cold
Burr
Little Burr
Mill
Davis
Knack
Frost
Martin
Bosworth
Barn
Boulder Flat
Hayfield
McMahon
Cooper
Mountain
Eel River
Area of Detail
Northern CA Steelhead DPS
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)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	93.71% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	34.69% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>88.4 < 1768 = >1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 33	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	13.5% (0.85mm) and <30% (6.4mm)	Good
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	59 to 80% depending on report of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair

			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	93.71% 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)	45% 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	34.69% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good

			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <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)	34.62% 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
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km	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	0.22-0.35	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	93.71% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	34.69% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
		Size	Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		>8840<176800 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.03% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	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	44.22% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	6.83 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.01 Miles/Square Mile	Poor
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)	NA	
			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)	NA	
			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	NA	
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NA	

					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	NA	
			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	NA	
			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)	NA	
			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)	NA	
			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	NA	
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	NA	
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	NA	
			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)	NA	
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	NA	
		Size	Viability	Abundance					NA	

Larabee 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	Low	Medium	Low		Medium
2	Channel Modification	Low	Low	Medium	Medium	High	Low		Medium
3	Disease, Predation and Competition	Low		High	Low	Medium	Low		Medium
4	Hatcheries and Aquaculture	Low		Low	Low	Low			Low
5	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Medium		Medium
6	Fishing and Collecting	High		Low		Low			Medium
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Low		Medium
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Medium	High		Medium
9	Mining	Low	Low	Medium	Low	Low	Low		Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low		Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low		Low
12	Roads and Railroads	Medium	Medium	High	Medium	Medium	High		High
13	Severe Weather Patterns	Medium	Low	Medium	Low	Low	Medium		Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low		Medium
	Threat Status for Targets and Project	High	Medium	High	Medium	High	High		High

Larabee Creek, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LarbC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LarbC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
LarbC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	2	1	Private	115					115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
LarbC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows to re-connect the floodplain, guided by assessment.	2	10	Private						TBD	Based on amount of habitat identified to be reconnected from fish/habitat restoration assessment in action step above. Cost estimated at $37,200/acre.
LarbC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LarbC-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
LarbC-NCSW-5.1.1.1	Action Step	Passage	Remove road crossing barrier on Larabee Ranch.	2	1	Private	260					260	Cost based on replacing culvert at a rate of 259,870/culvert.
LarbC-NCSW-5.1.1.2	Action Step	Passage	Assess passage at logjam barriers in tributaries and provide passage if feasible.	2	5	Private						TBD	
LarbC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LarbC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
LarbC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	1	CDFW	115					115	Mainstem Larabee Creek and lower tributaries. Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
LarbC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Place LWD, boulders, or other instream structure, guided by assessment.	2	5	CDFW						TBD	Mainstem Larabee Creek and lower tributaries. Costs will vary depending on methods implemented and extent of rehabilitation. Cost for stream habitat complexity estimated at $26,000/mile.
LarbC-NCSW-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LarbC-NCSW-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
LarbC-NCSW-14.1.1.1	Action Step	Disease/Predation/Competition	Conduct studies to determine distribution and habitat preferences of pikeminnow in the Eel River basin.	2	5	CDFW						TBD	
LarbC-NCSW-14.1.1.2	Action Step	Disease/Predation/Competition	Conduct studies to determine how competition with pikeminnow alters the natural behavior and survival of juvenile salmonids.	2	5	CDFW						TBD	
LarbC-NCSW-14.1.1.3	Action Step	Disease/Predation/Competition	Assess feasibility and benefits of various methods to eradicate or suppress Sacramento pikeminnow, including genetic technology methods (e.g., deleterious genes).	2	5	CDFW						TBD	
LarbC-NCSW-14.1.1.4	Action Step	Disease/Predation/Competition	Take measures to eradicate or suppress fish species using genetic technology or other methods identified as feasible.	2	25	CDFW						TBD	
LarbC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										

Larabee Creek, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LarbC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
LarbC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS						0	Action is considered In-Kind
LarbC-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to improve protection for salmonids by modifying California Code Regulations 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
LarbC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LarbC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
LarbC-NCSW-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription for benefits to listed salmonids.	2	1	Private						0	Lower mainstem Larabee Creek. Action is considered In-Kind
LarbC-NCSW-19.1.1.2	Action Step	Logging	Thin, or release conifers, guided by prescription.	2	10	Private						TBD	Lower mainstem Larabee Creek. Costs will vary depending on methods implemented and extent of rehabilitation. Riparian thinning estimated at $1,468/acre.
LarbC-NCSW-19.1.1.3	Action Step	Logging	Plant conifers, guided by prescription.	2	10	Private						TBD	Lower mainstem Larabee Creek. Costs will vary depending on methods implemented and extent of rehabilitation. Cost for riparian planting estimated at $20,719/acre.
LarbC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LarbC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
LarbC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	2	1	Private						TBD	Total road miles in watershed is unknown. Cost for road inventory estimated at $957/mile.
LarbC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	2	10	Private						TBD	Cost for number of miles of road to decommission is unknown. Cost to decommission is estimated at $12,000/mile.
LarbC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	2	10	Private						TBD	Miles to upgrade is unknown. Cost to upgrade is estimated at $21,000/mile.
LarbC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	25	Private						0	Action is considered In-Kind
LarbC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
LarbC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams etc.)										
LarbC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance which minimizes effects of road maintenance and construction on salmonid habitat.	2	1	County						0	Action is considered In-Kind

Middle Fork Eel River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 9,400 adults
- Current Intrinsic Population: 472.4 IP-km

NC Steelhead Summer-Run

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

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

Steelhead Abundance and Distribution

The historical population abundance of adult steelhead in the Middle Fork Eel River was estimated to be 17,000 spawners, which includes about 2,000 summer steelhead (CDFG 1966). An earlier abundance estimate for the summer run population reported in Jones (1992) was made by hikers in the mid-1930s, which estimated summer steelhead at 6,000 adult fish. Currently, the Middle Fork Eel River population of summer steelhead is the largest in California, where annual counts between 1966 and 2003 have ranged from 196 to 1601 adult fish (Harris 2002). The most recent estimate for summer steelhead in the Middle Fork Eel was 523 in 2010 (S. Harris, CDFW personal communication 2010). No current abundance estimate is available for the winter run population in the Middle Fork Eel River.

Limited juvenile steelhead distribution surveys have been conducted by CDFW and other agencies in this basin. Existing habitat typing surveys and other stock assessment surveys as recent as 2009 show presence of juvenile steelhead in most tributaries, and the upper reaches of the Middle Fork Eel River. The lower 25 miles of the mainstem below the confluence of the Black Butte River has historically had elevated stream temperatures and limited presence of salmonids during the summer months (DWR 1965). When current steelhead distribution is compared to the potential historic habitat proposed by Spence *et al.* (2008), the current juvenile distribution occurs

in about 50 to 75 percent of the potential historic habitat. No current abundance estimates are available for adult winter steelhead or smolts in this watershed.

Areas of higher quality habitat in this basin exist within the upper reaches of Black Butte River and its tributaries such as Estell Creek. Medium quality habitat exists in stream reaches of Williams Creek, and the upper Middle Fork Eel River and its tributaries.

History of Land Use

The first human inhabitants of the Middle Fork Eel watershed were the Yuki Indians which populated the lower elevations in the winter, and moved to the higher elevations in the summer to hunt and fish. In 1870, the Round Valley Reservation was established where Yuki, Wylaki, and another 5,000 people from 14 Indian tribes were brought onto the reservation (Eargle 1986, as cited by USFS 1995).

The first extensive land use occurred in the Middle Fork Eel River watershed in the late 1800s and early 1900s with severe overgrazing in some areas (USEPA 2003). Logging activities began around 1862 near Covelo, continuing until after World War II, when private lands were extensively cut and burned. The harvest of public lands of Mendocino National Forest began in 1958. It is estimated that 46 percent of the timberland in the basin (23 percent of the watershed) was logged by either clear cut or partial cut from 1950 - 1981 (DWR 1982).

The U.S. Environmental Protection Agency (EPA) has categorized the drainage as sediment and temperature impaired due to unstable geology and damage from the 1964 flood. The primary cause of today's higher sedimentation rates are attributed to the effects of the 1964 flood which were exacerbated by land management activities in the basin. Reports by CDFW after the 1964 flood describe the deep pools used by summer steelhead filled with 10 to 40 feet of sediment (Jones 1992). Since the mid-1970s the USFS has reported recovery of channel conditions in the upper reaches of the Middle Fork Eel River, noting that aerial photos show that areas look the same in 1993 as they did in 1961 (USEPA 2003). Other subbasins such as the Black Butte River have not recovered at the same rate as the upper Middle Fork Eel, with lower reaches continuing to show effects of aggradation from the 1964 flood (USEPA 2003).

Current Resources and Land Management

The Middle Fork Eel River watershed encompasses an area of 753 square miles (482,000 acres), and is mixed in ownership with 51 percent Federally managed (USFS and BLM), 4 percent in the Round Valley Indian Reservation, and 45 percent in private holdings. There are two wilderness areas managed by the USFS, the Yolla Bolly (approximately 150,000 acres) and the Yuki

Wilderness area which encompasses 53,887 acres. The USFS manages the majority of the upper watershed in the Middle Fork Eel River and Black Butte River under the Land and Resource Management Plan (LRMP) for the Mendocino National Forest. The Round Valley Indian Tribe (RVIT) manages their portion of the watershed under a Resource Management Plan. Both the USFS and RVIT are currently involved in restoration actions that include road upgrades/decommissioning and major stream restoration in Mill Creek by the RVIT, near the town of Covelo.

Private lands are characterized by large ranches, smaller private ownerships and some private industrial timberland. The Round Valley area is an interior valley consisting of pasture land and the main human population of about 2,000 residents which includes some tribal lands mixed with private ownerships around the town of Covelo.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, riparian tree diameter, shelter rating, primary pool frequency, and pool riffle ratio for adults and juvenile lifestages. Gravel embeddedness was rated Poor for the egg lifestage and food production for juvenile fish. The only indicator for watershed process that was rated as Poor through the CAP analysis was road density within riparian areas. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes. Indicators that are rated as Fair through the CAP process, but are considered important within specific areas of the watershed include baseflow, canopy cover, and toxicity of tributary streams during the juvenile rearing period.

Current Conditions

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

Population and Habitat Conditions

Habitat Complexity: Large Wood and Shelter

Suitable shelter ratings are required for juvenile salmonids as well as adult spawners for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. Data from CDFW habitat inventories indicate shelter ratings throughout the Middle Fork Eel River and its tributaries are poor with 40 percent of the potential habitat meeting suitability targets for shelter. Poor to fair LWD ratings were also documented

within these drainages, due largely to a lack of functional riparian corridors and recruitment of large conifer and hardwoods species from adjacent upslope areas. Reduced shelter ratings in most stream reaches likely limit the quality of available habitat for juvenile fish survival during critical low summer periods and high flow periods in the winter. In addition, shelter in pools that provide habitat for summer steelhead may be lacking due to impacts of major floods in the past.

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

The frequency of primary pools is poor in most of the tributary streams habitat typed by CDFW in this basin. Habitat Complexity conditions have an overall rating of Poor due to the overall lack of pools for summer rearing of juvenile steelhead. Most sampled streams have a high percentage of flatwater or run habitat that are not preferred by rearing lifestages of salmonids due to the general lack of depth, complexity and velocity refuge. The lack of pools in this basin likely limits the space available for larger juveniles (e.g. yearling or two year old fish) attempting to maintain territory for feeding and protection from predators. Lack of pool habitats in the all surveyed stream in this basin stems from high sediment production (pool filling) and loss of LWD recruitment from past land use practices and large flood events.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Spawning habitat quality is poor in parts of the basin due to road related and chronic mass wasting from slides that occur in the basin. While some recovery of large sediment pulses from the 1955 and 1964 flood events has occurred, road systems, high natural erosion rates, existing slides and grazing to some extent result in high sediment loads that continue to cause reduction in egg survival, reduce food production and pool volume for juvenile rearing.

Other Current Conditions

Unsuitable summer water temperature is limiting steelhead survival in some tributaries in this watershed such as the lower reaches of the Black Butte River and Elk Creek. Tributaries within the Covelo Valley are stressed by low summer baseflow and elevated stream temperatures. Much of the mainstem of the Middle Fork below the Black Butte River has historically had stressful summer temperatures for juvenile salmonids. Altered riparian canopy received a Medium rating due to the recovery that has occurred from past land use and natural events such as the 1964 flood. According to USEPA (2003), small (2-3 percent) improvements in canopy in the tributaries and slightly larger (9 percent) in the mainstem reaches are needed to meet natural background levels for this basin.

Water diversion from large illegal cannabis producers and associated rural residential water user is likely reducing summer baseflow. Low summer baseflow is expected in some reaches due to

the warmer interior environment of the Middle Fork Eel River watershed. Additional stress to surface flow from cannabis and rural residential diversions is likely a Fair threat limiting steelhead production in this watershed, and is likely to increase in the future. Stream reaches located in the Round Valley area typically have very low surface flow or are dry throughout the summer months. These streams have been highly altered for agriculture and grazing, but are likely impacted by water diversions that occur throughout the valley and surrounding watershed.

Reduced numbers of adult spawners, juveniles and smolts is an imminent stress to the population in this basin. Viability: Density conditions have a rating of Fair due to impacts of poaching in the upper Middle Fork Eel River on the adult summer steelhead population. Predation by introduced and predatory Sacramento pikeminnow has likely contributed to the reduction in density of juvenile steelhead in the Middle Fork Eel River.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Middle Fork Eel River CAP Results). Recovery strategies will 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 Middle Fork Eel River CAP Results.

Roads and Railroads

The greatest road related sediment production in this watershed is from the subbasins that are predominately in private ownership. USEPA (2003) reports that Elk Creek (60 tons/square mile/year) and Williams/Thatcher (170 tons/square mile/year) subbasins produce the highest volume and density of surface and gully erosion in the basin. Riparian road densities associated with multiple land uses such as forest roads and private ownerships continue to reduce salmonid habitat suitability by delivering fine sediment to spawning and rearing reaches.

Fire, Fuel Management and Fire Suppression

Fire and fuel management associated with high fuel loads exists in the southern portion of the watershed in the Black Butte and Elk Creek subbasins. Due to past fire suppression actions, the watershed had the potential for large scale, high intensity, stand replacing wildfires that can then result in increased sediment delivery to stream channels (USFS 1995). Since the late 1990s, the USFS has implemented prescribed burning to reduce the potential for high intensity fires. We rated fire and fuel management overall as a Medium threat in this watershed since management of fuel loads is has been underway for over two decades in the Mendocino National Forest. We rated the threat of fire and fuel management on the egg lifestage as High due to the potential for

sediment delivery to spawning channels in the event of a large fire that is likely based on past fire history in the watershed.

Fishing and Collecting

Poaching of adult summer steelhead has been documented by CDFW since surveys began in 1966. Recent surveys in the summer of 2010 reveal that poaching of summer run adult continues (S. Harris, CDFW, personal communication 2010). Increased cannabis production noted during the 2010 adult summer steelhead survey has added an additional group of people in this area that are poaching adult fish while conducting illegal cannabis activities.

Recreational sport fishing is allowed in the Middle Fork Eel River for adult winter run and summer run steelhead during the winter and spring months. A relatively small number are caught by anglers and reported through the Steelhead Report-Restoration Card Program. Between 2003 and 2005 anglers reported 23 adult steelhead caught and released and one kept (CDFG 2007), with some incidental mortality likely associated with the released fish. A lesser number of juvenile steelhead are likely caught by recreational anglers with some incidental mortality associated with this activity.

Disease, Predation and Competition

The introduction of pike minnow in the 1980s from Lake Pillsbury into the Eel River system continues to result in predation of juveniles and smolts that are produced in the Middle Fork and other areas of the Eel River watershed. Quantitative information is not available regarding the effects of predation on abundance of juvenile and smolt steelhead in the Middle Fork Eel River. Therefore, a Medium threat level was assigned to loss in abundance and competition that these non-native species present to juvenile lifestages of steelhead.

Severe Weather Patterns

Large flood events and drought are the greatest threat to this highly erosive watershed. Past flood events in 1995 and 1964 have had devastating effects to salmonid habitat by filling pools that are required in the summer for both adults and juvenile steelhead. These floods have also reduced canopy levels further impacting suitability stream temperatures for rearing juvenile salmonids. Drought conditions can reduce migration potential for both winter and summer spawners and reduce suitability of stream temperature for juvenile fish in the spring and summer through reductions in snowpack and subsequent runoff.

Low or Medium Rated Threats

Agriculture

Cannabis production is a serious and growing threat in this watershed and other watersheds in this area. In the Outlet Creek watershed which has similar cannabis production issues, LeDoux-Bloom and Downie (2008) documented that diversion from large grow operations resulted in dry channels, stranded or dead juvenile salmonids, and a reduction in migration due to these impacts. During 2010 summer steelhead surveys in the Middle Fork Eel River, CDFW biologists noted increased cannabis operations (S. Harris, CDFG personal communication 2010), and biologists conducting field surveys in the Black Butte River report similar activities (L. Morgan, USFS personal communication 2011). These large (thousands of plants) illegal grow operations require water diversions to supply plants during the summer growing season. This threat is likely to continue and become an increased source of stress on baseflow and water quality for juvenile salmonids over the next decade.

Logging and Wood Harvesting

The USFS and RVIT will continue to conduct timber harvest activities within the watershed. RVIT timber harvest actions will take place in the northwest portion of the Middle Fork Eel River watershed and focus on fuels reduction and sustained yield management objectives (RVIT 2002). The USFS also conducts fuels reduction and timber production while providing for other resource objectives including protection of visual quality, watershed, rare and endemic species, and wildlife (USFS 1995). These timber harvest activities are much improved from past practices that led to unstable slopes and reduced LWD recruitment, therefore, the threat of future timber harvesting in this watershed was rated as Medium.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests both adult and juvenile survival is likely limiting steelhead recovery in the Middle Fork Eel River watershed. Unsuitable shelter rating and pool habitat are rated as a High stress for summer and winter rearing. Reduced density of spawning adults from poaching was identified as a High stress to summer steelhead. Gravel quality for egg survival and food production for juvenile rearing had High stress rating for this population.

Impacts to amount of baseflow and water quality during the summer from water diversions and introduction of toxins associated with cannabis production impact salmonid rearing habitat suitability in some tributary reaches which were rated as a Medium stress on juvenile rearing. Also shade canopies rate as Poor for many surveyed reaches in the watershed; stream temperatures across much of the basin contribute to reduce juvenile habitat suitability. Restoration actions should address these issues within specific subbasins to increase juvenile steelhead survival and carrying capacity in tributaries.

General Recovery Strategy

In general, recovery strategies will focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Increase Instream Shelter Ratings and Pool Frequency

Improvement in shelter conditions in most stream reaches in the Middle Fork Eel River watershed is needed. Due largely to past aggradation, and absence of LWD, quality pool habitat is reduced and shelter components are comprised mainly of cobble and boulder. Restoration efforts should focus on protection of large conifers and riparian areas for future recruitment of LWD to improve shelter, and sediment reduction to improve pool frequency. Although pool depth in the upper Middle Fork Eel River is reported to have recovered, the need for additional cover in the form of large boulders or LWD needs further investigation.

Reduce Sediment Delivery from Road Systems

Many of the road systems on USFS lands, private timberlands, and tribal lands need to be upgraded or decommissioned. Road upgrades and stream crossing repair throughout the watershed will reduce fine sediment delivery to streams and reduce the probability of triggering large landslides. The frequency of severe weather patterns is expected to increase, and, therefore, roads in this basin must be disconnected from the stream network or decommissioned to provide resiliency to large flood events that have had devastating effects to salmonid habitat in the past.

Reduce the Potential for Stand Replacing Fire

Work with the USFS and private landowners on fuels reduction projects in the Mendocino National Forest and private lands. The USFS continues to implement fuels reduction projects that include prescribed fire, mechanical fuels reduction, and thinning to reduce the potential for stand replacing fire. The continued implementation of fuels reduction projects will reduce the potential for fires that cause accelerated sediment delivery to fish bearing channels.

Reduce Illegal Poaching, and Recreation Fishing

Additional resources must be allocated to protect summer steelhead adults from poaching during the summer and fall months. Reduction or halting recreational fishing for adult steelhead in the Middle Fork basin should be considered to reduce incidental take from recreational steelhead and

trout fishing. Coordination with the RVIT should be conducted to minimize take on tribal lands in order to aid recovery and ensure future use by tribal members.

Address Water Diversion and Toxic Materials

Reduced flow conditions, and disconnected flow conditions (dry stream channels), water diversions and groundwater pumping must be minimized to protect and increase juvenile steelhead survival. Federal, state and local government representatives should work with landowners to implement creative solutions that minimize these effects; these solutions should examine conservation methods, water management planning, and water storage and recharge solutions in the Covelo area of the watershed. In addition, improved coordination between NMFS, CDFW, BLM, and USFS and county law enforcement agencies must be implemented to reduce the number of illegal stream diversions within this basin. Additional law enforcement actions to reduce illegal water diversions are expected to reduce the level of toxic materials entering surface waters from cannabis operations. Funding must also be provided for the cleanup of cannabis production sites to minimize future release of toxic material into stream channels.

Improve Canopy Cover and LWD Volume

Tributaries streams within this watershed would benefit from improved riparian composition and structure, which would increase stream shading, improve LWD recruitment, and increase instream shelter for juvenile fish. General practices to improve riparian condition include increased number of riparian conservation easements (Covelo area), reduced harvest and improved protection of riparian areas, riparian planting and livestock exclusion fencing where appropriate.

Improve Migration Barriers

Support CDFW staff biologist recommendations regarding migration issues on the Middle Fork Eel River, such as the ASA Bean roughs. This is an ongoing issue for summer steelhead adults that get stranded and often perish when this reach dries during summer. Manmade barriers documented in the Fish Passage Assessment database should be investigated to develop site specific projects to improve or restore passage to spawning and rearing in headwater reaches of this basin.

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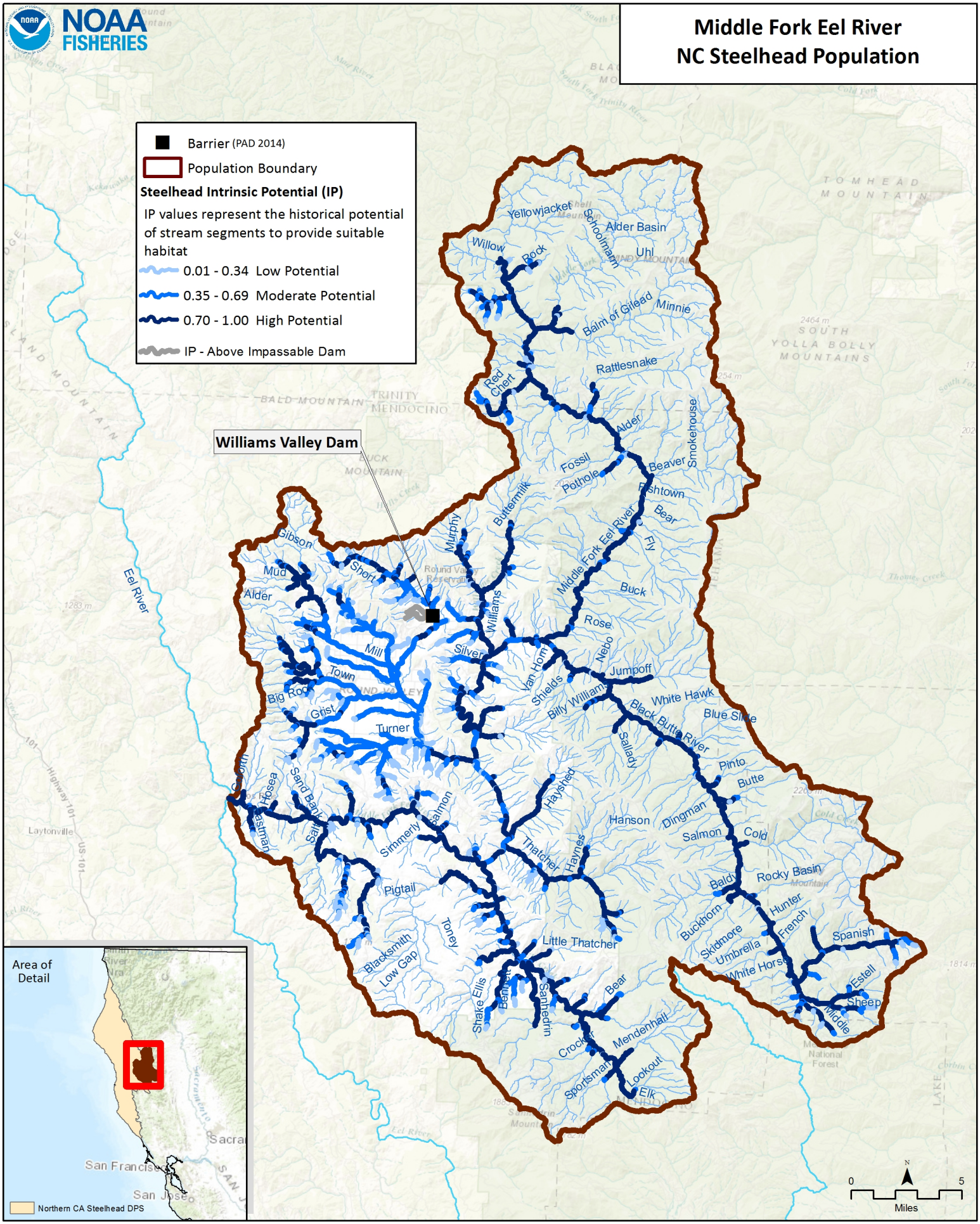
NOAA FISHERIES
Middle Fork Eel River
NC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
Williams Valley Dam
Yellowjacket
Schoolmarm
Alder Basin
Willow
Rock
Uhl
Balm of Gilead
Minnie
Rattlesnake
Red Chert
Alder
Smokehouse
Fossil
Pothole
Beaver
Fishtown
Bear
Buttermilk
Murphy
Middle Fork Eel River
Fly
Gibson
Mud
Short
Alder
Eel River
Buck
Rose
Williams
Mill
Silver
Nebo
Van Horn
Town
Jumpoff
Shields
Billy Williams
White Hawk
Big Rock
Grist
Blue Slide
Black Butte River
Turner
Sallady
Pinto
Butte
Hosea
Sand Bank
Haysfield
Salmon
Hanson
Dingman
Salmon
Cold
Simmerly
Thatcher
Haynes
Rocky Basin
Baldy
Pigtail
Hunter
Buckhorn
French
Toney
Skidmore
Spanish
Little Thatcher
Umbrella
Blacksmith
Low Gap
White Horse
Estell
Shake Ellis
Sanhedrin
Bear
Sheep
Middle
Mendenhall
Crocker
Sportsman
Lookout
Elk
Laytonville
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
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 (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	38% streams/ 13% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	6% sreams/ 15% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	38% streams/ 13% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.5 Diversions	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >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)	44% streams/ 18% 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	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	38% streams/ 13% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.5 Diversions	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		58,100-1,160,000 = Smolt abundance which produces moderate risk spawner density	Fair

									per Spence (2008)	
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.086% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.368% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	1% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.5 Miles/Square Mile	Very Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	1.2 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-km (>20% staging pool frequency)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good

			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/ 20% IP-km (>50% stream average scores of 1 & 2)	Poor
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Fair
			Water Quality	Mainstem Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
		Size	Viability	Abundance					8-13 adults per IP-km	Fair

Middle Fork Eel River CAP Threat Results

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

Middle Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
MFER-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MFER-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
MFER-NCSW-5.1.1.1	Action Step	Passage	Evaluate existing passage information documented by CDFW, or other agencies.	2	5	CDFW, NMFS, Private Landowners						0	Action is considered In-Kind
MFER-NCSW-5.1.1.2	Action Step	Passage	Develop a high priority list of fish passage projects based on CDFW, USFS, and Round Valley Indian Tribe recommendations.	2	10	CDFW, NMFS, Private Landowners						TBD	Estimate can not be made at this time.
MFER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MFER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency										
MFER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a plan or priority list that identifies specific stream reaches that would be suitable for conducting instream habitat complexity projects.	1	1	CDFW, NMFS, Round Valley Indian Tribe, USFS	115					115	Cost based on fish/habitat restoration model at a rate of $114,861/project.
MFER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement a large woody debris or other large roughness elements supplementation program to increase stream complexity to improve pool frequency and depth based on a plan or priority list.	3	10	CDFW, NMFS, Round Valley Indian Tribe, USFS	610	610				1,220	Cost originally based on treating 47 miles (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile. However, cost was modified based on conditions and actual experience and increased by a factor of 10.
MFER-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners (private, USFS, and Round Valley Indian tribe) to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	1	20	CDFW, Private Landowners, USFS						0	Action is considered In-Kind
MFER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MFER-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover										
MFER-NCSW-7.1.1.1	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	2	20	CDFW, NMFS, Round Valley Indian Tribe, USFS	1,243	1,243	1,243	1,243		4,972	Cost based on treating 10 miles (assume 1 project/mile in 5% high IP with 24 acres/mile) at a rate of $20,719/acre.
MFER-NCSW-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	3	50	CDFW, Mendocino County RCD, NMFS, Private Landowners						TBD	No cost estimate can be made at this time.
MFER-NCSW-7.1.1.3	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	1	60	CalFire, County of Mendocino, NMFS						0	Action is considered In-Kind
MFER-NCSW-7.1.1.4	Action Step	Riparian	Prioritize and fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	20	CDFW, Mendocino County RCD, NRCS, Private Landowners						TBD	No cost estimate can be made at this time. Cost for riparian exclusion fencing estimated at $3.63/ft.
MFER-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**										
MFER-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										

Middle Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
MFER-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	3	100	CalFire, County of Mendocino, NMFS						0	Action is considered In-Kind
MFER-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Work with CDF to reduce fuel loads on private lands of high priority within the Middle Fork Eel River.	3	25	CalFire, County of Mendocino, NMFS						0	Action is considered In-Kind
MFER-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Work with USFS to reduce fuel loads in the Mendocino national Forest.	3	20	CalFire, NMFS, USFS						0	Action is considered In-Kind
MFER-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy or existing regulatory mechanisms**										
MFER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
MFER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Improve CDFW fishing regulations to minimize incidental take of adult and juvenile steelhead.	2	100	CDFW, CDFW Law Enforcement, NMFS, USFS						0	Action is considered In-Kind
MFER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Reduce incidental take of adult and juvenile steelhead by recreational anglers.	3	20	CDFW, CDFW Law Enforcement, NMFS, USFS						0	Action is considered In-Kind
MFER-NCSW-16.1.1.3	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead.	1	10	CDFW, CDFW Law Enforcement, NMFS, USFS						0	Action is considered In-Kind
MFER-NCSW-16.1.1.4	Action Step	Fishing/Collecting	Provide additional funding for COMMET, and USFS law enforcement to reduce illegal cannabis activities that result in increased poaching of adult steelhead and protect water quality by preventing the introduction of fertilizer and chemicals into water, and protect water quantity by halting unauthorized stream diversions.	1	10	CDFW Law Enforcement, COMMET, NMFS OLE, USFS						TBD	
MFER-NCSW-16.1.1.5	Action Step	Fishing/Collecting	Provide additional funding for CDFW law enforcement to improve protection from poaching activities in the Middle Fork Eel River.	1	20	CDFW Law Enforcement, NMFS OLE, USFS	250	250	250	250		1,000	Estimate of 50K for 20 years.
MFER-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MFER-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
MFER-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	1	10	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners	531	531				1,061	Cost based on road inventory of 1108 miles of road network at a rate of $957/mile.
MFER-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement road upgrades at high priority sites or systems.	2	10	CDFW, Glenn County, Mendocino County RCD, NMFS, NRCS, Private Landowners	2,909	2,909				5,817	Cost based on upgrading 25% of road network at a rate of $21,000/mile.
MFER-NCSW-23.1.1.3	Action Step	Roads/Railroads	Implement road upgrades and/or decommissioning on industrial timberland in the upper Black Butte watershed.	1	10	CDFW, NOAA RC, Private Landowners						0	Cost accounted for in above action step.

Middle Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
MFER-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade USFS roads that are used for public or administrative use. Decommission roads in the Mendocino National Forest based on USFS prioritization.	1	10	CDFW, NOAA RC, USFS	10,000	10,000				20,000	This estimate based on CDFW and USFS rough estimates.
MFER-NCSW-23.1.1.5	Action Step	Roads/Railroads	Work with the County of Mendocino DOT to upgrade existing high priority riparian road segments identified by the county.	1	10	CDFW, County of Mendocino, NMFS						400	Estimate 20 miles at 20k
MFER-NCSW-23.1.1.6	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority roads, or those identified in a sediment reduction plan.	2	10	CDFW, NMFS, Private Landowners	400.00	400.00				800	Estimate 40 miles at 20k
MFER-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
MFER-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
MFER-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Develop and implement a plan to minimize further diversion of surface flow during the summer period.	3	10	CDFW, Private Landowners	32.50	32.50				65	Cost based on stream flow/precipitation model at a rate of $65,084/project. Conservation measures and additional action steps will be determined once a flow model is conducted.
MFER-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Develop off channel water storage for grazing, cannabis operators, and rural residential users within the watershed to increase summer surface flow across the watershed.	1	20	CDFW, Private Landowners	125.00	125.00	125.00	125.00		500	Estimate a minimum of 100 participants at 5K.
MFER-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	3	20	CDFW, Private Landowners						0	Action is considered In-Kind
MFER-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
MFER-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
MFER-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	30	CDFW Law Enforcement, COMMET, NMFS OLE, SWRCB						0	Action is considered In-Kind
MFER-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	10	CDFW Law Enforcement, COMMET, NMFS OLE, SWRCB	1,000	1,000				2,000	Rough estimate based on proposed actions to eradicate cannabis in the Mendocino National Forest in 2011.
												37,950	

North Fork Eel River Population

NC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 6,300 adults
- Current Intrinsic Potential: 317.0 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 estimates of adult NC steelhead are lacking for the North Fork Eel River. However, available information indicates the steelhead population has declined dramatically over the last century. Keter (1995) estimated the pre-human settlement annual run-size to be approximately 6,930 spawners, with the qualification that numbers may have been higher historically due to better habitat conditions. This estimate was based on interviews and the assumption that the watershed supported 150 spawners per mile. California Department of Fish and Wildlife (CDFW) estimated, based on knowledge from similar streams, that the North Fork Eel River may have supported a population of 5,000 spawners in 1964 (CDFG 1965). Little is known about summer-run steelhead in the population area, although the lack of even anecdotal reports in recent years suggests that the run is either extirpated or extremely depressed (Spence *et al.* 2008).

Split Rock, a large rock in landslide debris located approximately 3.5 miles upstream of the confluence with the mainstem Eel River, likely functions as a migration barrier to adult steelhead at certain flows (USFS and USBLM 1996). No other salmonid species, as well as the non-native Sacramento pikeminnow, are believed to bypass the Split Rock barrier, and are therefore restricted to the lower reach of the North Fork Eel River. There are no known manmade barriers.

History of Land Use

Historic land use of the North Fork Eel River consisted primarily of episodic timber harvest and intense livestock grazing. Euro-American Settlers first arrived in 1854 and by the 1870s approximately 60,000 sheep were grazing within the watershed (USFS and USBLM 1996). Intensive timber harvest on private lands occurred in the 1950s and 1960s, predominately by tractor-logging which commonly occurred on slopes greater than 70-percent (USFS and USBLM 1996). Timber harvest on public lands peaked on USFS lands during the 1970s, with approximately 1,200 acres clear cut during that time (USFS and USBLM 1996).

Stream habitat in the North Fork Eel River has been significantly modified by both human and natural causes. The flood of 1964 severely modified the stream channel and riparian vegetation. A local resident indicated that the "channel was so heavily filled with soil and debris that the river bed was level and vehicles could drive for miles up the river bed" (Keter 1995). USFS (2002) noted that approximately 90 percent of the mainstem North Fork Eel River riparian canopy was removed by the 1964 flood. Large landslides continued to fill in the stream bed years after the flood, severely aggrading the channel (USFS 2002).

Potter Valley Project releases contribute to flows for the entire extent of the mainstem Eel River (VTN 1982; SEC 1998) and thereby influence rearing and migration conditions for juvenile steelhead in the mainstem and estuary, and staging, holding, and upstream migration conditions for adult summer steelhead. Project releases generally approximate unimpaired flows during the summer and fall (NMFS 2002), but may deviate from the natural hydrograph during the winter and early spring as runoff is impounded to fill the Lake Pillsbury reservoir. Sacramento pikeminnow were introduced to Lake Pillsbury in 1980 (CDFG 1997), and have since colonized all accessible reaches of the Eel River watershed. This predator thrives in the warmer waters created within the reservoir, as well as the shallow mainstem reaches caused by high sediment loads, and degraded riparian forests. In the Eel River estuary, construction of dikes and levees resulted in a mass conversion of tidelands to pasture.

Current Resources and Land Management

Approximately 50 percent of the North Fork Eel River basin is Federally managed (41 percent Six Rivers National Forest, 9 percent Bureau of Land Management). Ranches, rural residences, private timberlands, and the Round Valley Indian Reservation make up the remaining 50 percent. Federal lands are currently managed under the Northwest Forest Plan, with 35 percent of Federal lands "withdrawn" or designated wilderness; 21 percent classified as late successional reserve, and 44 percent classified as matrix (*i.e.*, resource extraction permitted). Grazing is currently managed by the Six Rivers National Forest and the Bureau of Land Management. Current

management practices of these land managers include monitoring rangeland conditions and resting allotments to allow recovery of vegetation. There are several active watershed groups in the area: the Eel River Watershed Improvement Group, Friends of the Eel River, and the Eel River Restoration Project.

The following are pertinent reports or plans for the North Fork Eel River:

- North Fork Eel River Watershed Analysis (USFS-BLM 1996);
- North Fork Eel River Total Maximum Daily Loads for Sediment and Temperature (USEPA 2002); and
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for steelhead (see North Fork Eel River CAP results): estuary quality and extent, large woody debris (LWD) frequency, pool/riffle/flatwater ratio, baseflow conditions, smolt passage flows, tree diameter, canopy cover, D50, stream-side road density, shelter rating, and temperature. Recovery strategies and actions will focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions with the population area.

Current Conditions

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

Population and Habitat Conditions

Viability: Density, Abundance, and Spatial Structure

Although steelhead juveniles are well distributed throughout the population area (Becker and Reining 2009), the abundance of North Fork Eel River steelhead is likely very limited compared to historical levels, and the degraded habitat in the population (SEC 2012) is likely incapable of producing the number of spawners needed for the population to be at Low risk of extinction (6,400 adults). In addition, the severely limited numbers of adult summer steelhead reflect a greatly diminished level of diversity for the population. Reduced density, abundance, and diversity conditions have an overall rating of Fair for winter-run and summer-run adult, smolt, and summer rearing juvenile steelhead.

Habitat Complexity: Large Wood and Shelter

Surveys conducted by CDFW indicate that shelter ratings are Very Poor throughout the population area, with only 39 percent of the IP habitat having met desired levels for shelter and LWD (SEC 2012). These habitat complexity features have primarily been impaired due to a deficit of streamside vegetation and a large supply of sediment. Currently, shelter primarily exists in the form of bedrock pools and undercut banks, as large wood retention is difficult in the steep and flashy channel networks typical of the population area. This condition has a rating of Poor for summer rearing and winter rearing juveniles, and summer-run adults.

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

Available data indicate that there are not enough suitable juvenile rearing pools or adult holding pools in the population area (SEC 2012). Increased sediment yield from roads and historic timber harvest activities, coupled with the extreme flood events of 1955 and 1964, has resulted in aggraded channels and shallow pools. Those pools available for juvenile use provide insufficient number and diversity of cover elements such as undercut banks, woody debris, and root masses (SEC 2012). This condition has an overall Poor rating for winter-run and summer-run adults, and summer rearing juveniles.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediment conditions have a rating of Fair for winter-run adults and eggs. The North Fork Eel River is listed as sediment-impaired under section 303(d) of the Clean Water Act (USEPA 2002). The Eel River is one of the most erodible watersheds in the United States because of highly active tectonics, highly erodible soils, and high precipitation (Brown and Ritter 1971). Fine sediment loads are at unacceptable levels in much of the North Fork Eel River (USEPA 2002), leading to highly embedded gravels and a small median particle size (SEC 2012). USEPA (2002) determined that approximately 30 percent of total sediment was related to human activity, which is lower than most watersheds studied in northern California. Excessive fine sediment can result in sub-surface flows, disconnected or discontinuous stream channels, poor spawning habitat for adults, suffocation of eggs, reduced velocity refugia for winter rearing juveniles, and reduced productivity of food for winter and summer-rearing juveniles. Although gravel quality is currently poor, improved management on Federal lands combined with natural passive recovery from the 1964 flood should produce more suitable gravels in the future.

Hydrology: Baseflow and Passage Flows

Many of the smaller tributaries in the North Fork Eel River population area dry up completely during the summer, and the mainstem North Fork Eel River channel becomes intermittently dry. The intermittent mainstem North Fork Eel River can prevent outmigration of summer-rearing

steelhead, effectively stranding them in potentially lethal waters. Several spring-fed tributaries in the population area maintain perennial flow or intermittent pools that serve as thermal refugia. Change from historic vegetative conditions in the North Fork Eel River watershed has resulted in increased density of brush and understory species and has likely resulted in ground water depletion (and, therefore, summer baseflow) through interception and evapotranspiration (Keter 1995).

Reduced summer flows in the mainstem Eel River, an important migratory corridor and rearing area for North Fork Eel River steelhead, can be partly attributed to increased evapotranspiration rates resulting from replacement of old-growth forests with younger forests (Perry 2007). Reduced flows in the mainstem Eel River also likely reflect increased demand for water for marijuana cultivation (S. Bauer, CDFW, personal communication, 1/17/13). Potter Valley Project releases generally approximate unimpaired flows during the summer and fall (NMFS 2002), but may deviate from the natural hydrograph during the winter and early spring as runoff is impounded to fill the Lake Pillsbury reservoir. Hydrology conditions have a rating of Poor for summer rearing juveniles and summer-run adults.

Water Quality: Temperature

The North Fork Eel River is listed as temperature-impaired under section 303(d) of the Clean Water Act (USEPA 2002). High summer water temperatures are a significant stress to the population, especially in the wide, exposed lower reaches of tributaries and in the mainstem river (CDFG 1997). The naturally hot climate, combined with low summer baseflows and a lack of riparian vegetation results in near-lethal or lethal water temperature in many parts of the population area. A thermal infrared and color videography snapshot of stream temperatures on the entire stretch of the mainstem North Fork Eel during July 2001 showed the mainstem North Fork Eel to be over 20°C (considered inadequate for steelhead) for its entire 35.3 mile extent, with many sections over 24°C (near lethal for steelhead) (USEPA 2002).

Summer juvenile distribution is likely limited to those areas of the watershed with cold spring upwelling or cold tributary inflow. It is likely that a proportion of juveniles leave the North Fork Eel River, as observed in the adjacent Middle Fork Eel River (Smith and Elwell 1961), prior to onset of summer baseflow to take advantage of more suitable conditions in the coastally influenced climate of the lower mainstem Eel River and Eel River estuary. This condition has a Poor rating for summer rearing juveniles and summer-run adults.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of Eel River salmonid populations. The Eel River estuary is

currently severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Riparian Vegetation: Composition, Cover & Tree Diameter

Due to fire suppression and changes in land use following settlement, former oak woodlands have been replaced by Douglas-fir forests in the North Fork Eel River population area (Keter 1995). This change from historic conditions has resulted in increased density of brush and understory species and has likely resulted in ground water depletion (and, therefore, summer baseflow) through interception and evapotranspiration (Keter 1995). These conditions have an overall Poor rating.

Sediment Transport: Road Density

High road densities within the population area are primarily associated with rural residences and past timber harvest. Of particular concern is the high density (2.26 miles/square mile) of roads within 100-meters of stream channels (SEC 2012). Although significant efforts to decommission and upgrade roads have occurred and continue to occur on Federal lands, road densities remain high on private lands. Sediment Transport conditions from road density has a rating of Poor for watershed processes.

Very Good or Good Current Conditions

Hydrology: Impervious Surfaces and Passage/Migration: Mouth or Confluence and Physical Barriers

Due to the lack of residential, urban, and industrial land use in the watershed, impervious surfaces are rare and therefore have an overall rating of Very Good. Few physical barriers exist in the watershed and steelhead have access to almost all of their historical habitat; therefore, physical barriers have an overall rating of Very Good. The majority of tributaries likely maintain connectivity with the mainstem throughout the wet season; therefore, passage conditions have a Good rating for winter and summer adults.

Threats

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

Roads and Railroads

A few lower subbasins have been subdivided and contain a high density of roads used year-round (CDFG 1997). These roads contribute fine sediment to streams and disrupt normal runoff patterns. Road decommissioning has occurred and continues to occur on Federally managed lands in the upper half of the population area. This stress is rated High for watershed processes.

Channel Modification

Channel modification was rated as a High stress for summer rearing juvenile and smolt steelhead. Channel modification is not a current concern within the North Fork Eel River population area, but the Eel River estuary and mainstem have been significantly channelized by dikes and levees and subsequent filling for ranching or livestock purposes. Please see the NC steelhead Eel River Overview for a complete discussion and recovery actions.

Fire, Fuel Management, and Fire Suppression

USFS and USBLM (1996) determined the North Fork Eel River watershed was at risk for high to extreme fire behavior. Ladder fuels, which provide the opportunity for ground fires to move upward, are common and create the potential for crown fires that can kill valuable riparian trees (USFS and USBLM 1996). Fire was rated as a High risk to summer rearing juveniles.

Low or Medium Rated Threats

Disease, Predation and Competition

Disease, predation and competition was rated as a Medium threat to summer rearing juveniles and smolt steelhead primarily due to the presence of the predatory non-native Sacramento pikeminnow. Several other non-native predators are known to exist, but the pikeminnow has become ubiquitous throughout the Eel River and its tributaries, and is a known predator of salmonids. Removal of pikeminnow has, on the whole, been unsuccessful in the Eel River. Pikeminnow thrive in waters warmer than those suitable for salmonids (Bettelheim 2001), so reducing water temperature to match salmonid habitat requirements would make the habitat less suitable to pikeminnow and may help control the species. The lifestages present in the North Fork (lower five miles downstream of Split Rock) and Mainstem Eel rivers during late spring and summer months are most vulnerable, as this is when conditions are most favorable to pikeminnow.

Livestock Farming and Ranching

Grazing pressure on Federal lands is light compared to historic levels and is being managed to minimize effects to steelhead habitat (USFS and USBLM 1996). However, grazing practices on

private lands is unknown and could be having localized effects to steelhead habitat. Therefore, livestock are believed to be a Medium threat to all lifestages of steelhead.

Severe Weather Patterns

The low summer flows and hot climate of the North Fork Eel River make the population area more sensitive to drought conditions. Rearing steelhead would likely not survive and would be forced to rear elsewhere.

Water Diversion and Impoundments

Although there are few diversions in the population area, any diversion or groundwater pumping in the summer exacerbates already stressful rearing conditions for steelhead.

Limiting Stresses, Lifestages, and Habitats

Juvenile steelhead are limited by poor rearing conditions during the summer months. Poor rearing conditions are primarily the result of intrinsically high water temperatures exacerbated by a lack of riparian cover, and low baseflows caused by channel aggradation and an altered riparian vegetation community. Summer juveniles and smolts are also at risk due to a lack of well-sheltered pool habitat, predation by Sacramento pikeminnow, and degraded and reduced nursery habitat in the estuary.

General Recovery Strategy

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

Focus Initial Efforts on Restoring Key Tributaries

Several tributaries to the North Fork Eel River have been identified as good steelhead habitat and capable of supporting high densities of steelhead (USFS and USBLM 1996). Efforts should be focused on these key tributaries in the early phases of recovery plan implementation, to ensure that conditions are improved in areas that are occupied and functional. These tributaries include West Fork North Fork Eel River, Bluff/Kettenpom creeks, Red Mountain Creek, Hull's Creek, and Asbill Creek (USFS and USBLM 1996).

Reduce Summer Water Temperature

High water temperatures limit growth and survival of juvenile steelhead. In streams with less than 80 percent shade canopy, riparian vegetation should be managed to increase shade. Livestock exclusion fencing should be used to protect riparian vegetation where feasible. Increasing instream flows should help reduce water temperatures.

Improve Summer Flows

Instream flows in the North Fork Eel River should be increased during the summer months by providing incentives to reduce diversions during the summer, establishing a forbearance program using water storage tanks to decrease diversions during periods of low flow, and creating water budgets to avoid over allocating water diversions. In addition, investigate whether encroachment of Douglas fir on former oak woodlands has affected groundwater recharge or streamflow.

Increase Habitat Complexity

Pools in the North Fork Eel River and mainstem Eel River are too simplified and shallow to support steelhead growth and survival. Large wood, boulders, or other instream structure should be added in proximity to cool water refugia in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be re-created in the low-gradient areas of the population area, as well as the lower mainstem Eel River.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor steelhead habitat conditions. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance which minimizes effects on salmonid habitat should be developed for building and maintenance of private roads.

Reduce Abundance of Sacramento Pikeminnow

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

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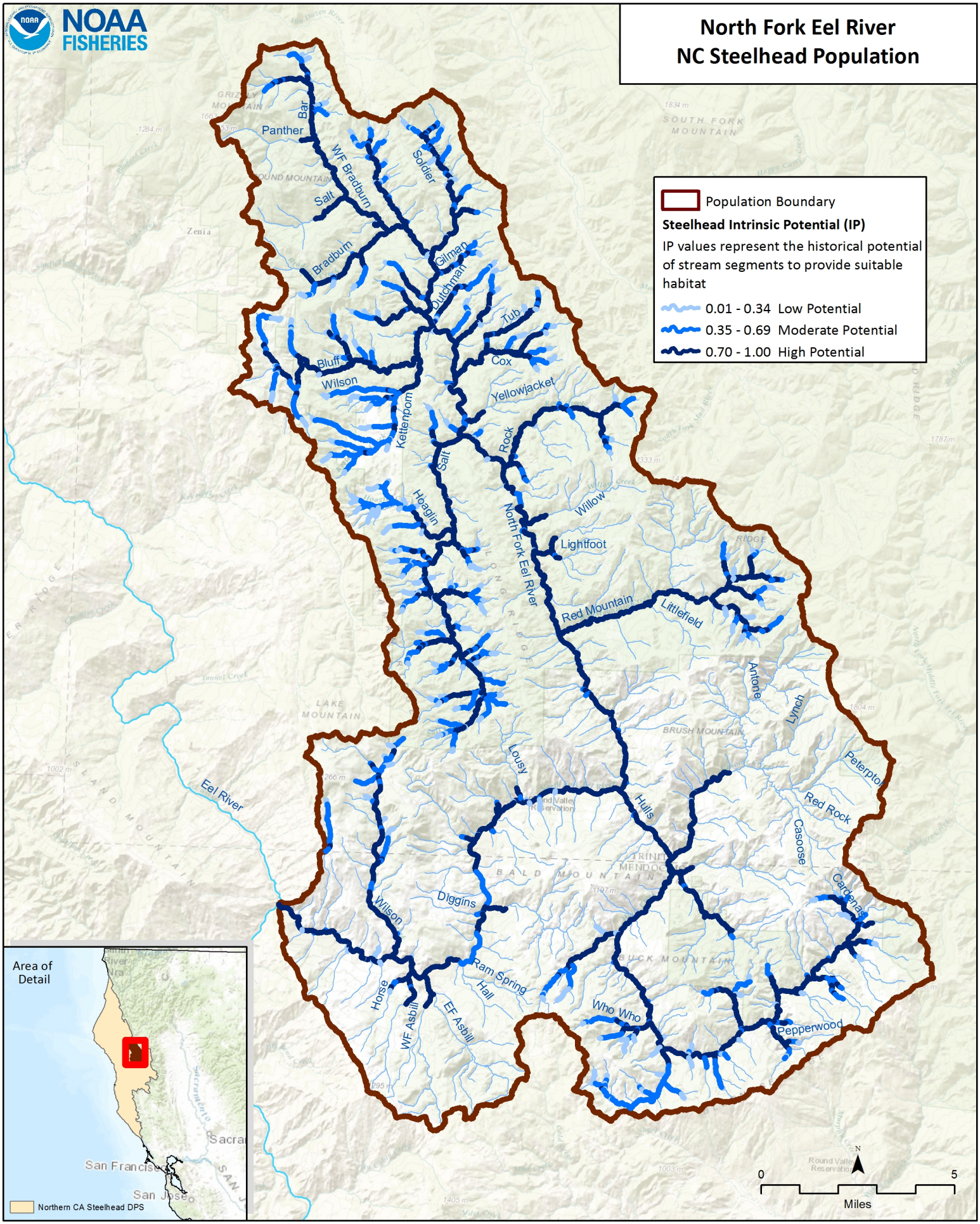
NOAA FISHERIES
North Fork Eel River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Panther
Bar
WF Bradburn
Soldier
Salt
Bradburn
Gilman
Dutchman
Tub
Cox
Bluff
Wilson
Yellowjacket
Kettenpom
Rock
Salt
Hoaglin
Willow
North Fork Eel River
Lightfoot
Red Mountain
Littlefield
Antone
Lynch
Peterpot
Red Rock
Casoose
Cardenas
Lousy
Hulls
Eel River
Wilson
Diggins
Ram Spring
Hall
Horse
WF Asbill
EF Asbill
Who Who
Pepperwood
Zenia
SOUTH FORK MOUNTAIN
LAKE MOUNTAIN
BRUSH MOUNTAIN
BALD MOUNTAIN
BUCK MOUNTAIN
Area of Detail
Sacra
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	Winter Adults	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	21% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	.22-.35	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	99.1 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	18.61% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		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)		318 to 6360 = low risk spawner density per Spence et al (2012)	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 23	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	72% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	16% of streams/ IP-Km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	21% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	.22-.35	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 83	Poor

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	Fair
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.05 Diversions/10 IP km	Good
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	99.1 of IP-km	Very Good
Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >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)	26% 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	18.61% Class 5 & 6 across IP-km	Poor
Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Poor
Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	72% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good

			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <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	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	21% of streams/ IP-Km (>30% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km	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	.22-.35	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	99.1 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	18.61% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	72% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
		Size	Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	Good

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.05 Diversions/10 IP km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	<50% IP-Km (>6 and <14 C)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.5	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	16.67	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		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)		31800 to 63600 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	36	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	0.04% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	7.68% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.96 Miles/Square Mile	Fair
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.26 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	<50% of streams/ IP-Km (>20% staging pool frequency)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	39% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 83	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	Good

					Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35	Factor Score 35-50	
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	70	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
		Size	Viability	Abundance					Few to none believed to occur in NF Eel	Poor

North Fork Eel River CAP Threat Results

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

North Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NFER-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
NFER-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	3	2	CDFW	288					288	Cost based on riparian and wetland restoration model at a rate of $73,793 and $213,307/project, respectively.
NFER-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Guided by assessment, re-connect the floodplain by constructing off channel ponds, alcoves, backwater habitat, and old stream oxbows.	3	10	CDFW						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
NFER-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
NFER-NCSW-3.1.1.1	Action Step	Hydrology	Assess whether Douglas fir encroachment on former oak woodlands has affected groundwater recharge or streamflow.	2	1	USFS						TBD	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Cost accounted for in other action steps.
NFER-NCSW-3.1.1.2	Action Step	Hydrology	If Douglas fir encroachment has reduced groundwater recharge or streamflow, re-establish a more natural vegetative community.	2	25	USFS						0	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Action is considered In-Kind
NFER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
NFER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	3	1	USFS	115					115	Tributaries, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Cost based on fish/habitat restoration model at a rate of $114,861/project.
NFER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Place instream structures, guided by assessment	3	10	USFS						TBD	Tributaries, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Costs will vary depending on methods implemented and extent of rehabilitation.
NFER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover										
NFER-NCSW-7.1.1.1	Action Step	Riparian	Plant native riparian species in denuded areas.	2	20							TBD	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Costs will vary depending on methods implemented and extent of rehabilitation.
NFER-NCSW-7.1.1.2	Action Step	Riparian	Remove non-native species that inhibit establishment of native riparian vegetation.	2	10							TBD	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Costs will vary depending on methods implemented and extent of rehabilitation.
NFER-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

North Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NFER-NCSW-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
NFER-NCSW-14.1.1.1	Action Step	Disease/ Predation/ Competition	Assess feasibility and benefits of various methods to eradicate or suppress Sacramento pikeminnow, including genetic technology methods (e.g., deleterious genes).	2	5	CDFW						0	Action is considered In-Kind
NFER-NCSW-14.1.1.2	Action Step	Disease/ Predation/ Competition	Take measures to eradicate or suppress fish species using genetic technology or other methods identified as feasible.	2	25	CDFW						0	Action is considered In-Kind
NFER-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
NFER-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Reestablish natural fire regime.	2	5	USFS						TBD	
NFER-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Identify areas prone to high severity fire and develop a strategic plan to reestablish a natural fire regime that benefits steelhead habitat.	2	5	USFS						TBD	
NFER-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Carry out fuel reduction projects such as thinning and prescribed burning, guided by the strategic plan.	2	100	USFS						TBD	
NFER-NCSW-16.1	**Objective**	**Fishing/Collectin g**	**Address the inadequacy of existing regulatory mechanisms**										
NFER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
NFER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS						0	Action is considered In-Kind
NFER-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
NFER-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										
NFER-NCSW-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from areas	3	1	NRCS, RCD	74	74	74				Cost based on riparian restoration model, which is accounted for in other action steps. If an additional assessment is needed, cost estimate at $73,793/project.
NFER-NCSW-18.1.1.2	Action Step	Livestock	Install fence, guided by plan	3	10	NRCS, RCD						TBD	Cost based on amount of livestock exclusion fencing needed. Cost estimate for livestock fencing is $3.63/ft.
NFER-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
NFER-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	3	1	Private						TBD	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Cost based on road inventory of road network estimated at $957/mile.

North Fork Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NFER-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	10	Private						TBD	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Cost based on amount of road network identified to be decommissioned. Cost for decommissioning roads estimated at $12,000/mile.
NFER-NCSW-23.1.1.3	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	25	Private						0	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Action is considered In-Kind
NFER-NCSW-23.1.1.4	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	25	Private						TBD	Population wide, especially Asbill, Bluff/Kettempom, Hull's, and Red Mountain creeks and West Fork North Fork Eel River. Cost based on amount of road network identified needing to be upgraded. Cost to upgrade roads estimated at $21,000/mile.
NFER-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NFER-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
NFER-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Increase instream flows by establishing a forbearance program, by using water storage tanks to decrease diversion during periods of low flow.	3	1							TBD	Cost based on amount of participation from landowners to increase instream flow. Cost for forbearance program estimated at $70,000/landowner.
NFER-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Monitor forbearance compliance and flows.	3	25							0	Action is considered In-Kind

Upper Mainstem Eel River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 4,200 adults
- Current Intrinsic Potential: 209.2 IP-km

NC Steelhead Summer-Run

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

Upper Middle Mainstem Eel River Population

NC Steelhead Summer-Run

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

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

Steelhead Abundance and Distribution

The watershed area that makes up the Upper Mainstem Eel River steelhead population begins at the confluence of Soda Creek (1.3 miles below Scott Dam) and extends upstream above Scott Dam (Lake Pillsbury), encompassing the Lake Pillsbury sub-basin and associated tributaries. Since 1922, adult steelhead have been counted at the Van Arsdale Fish Station (VAFS). VAFS is located 12 miles downstream of the Scott Dam, and approximately 10.5 miles downstream of Soda Creek. Information reported by Steiner Environmental Consulting (SEC; 1998) indicates relatively high numbers of adult steelhead were counted at VAFS in the 1930s, often exceeding 3,000 individuals. A decline in steelhead numbers was observed in the 1950s with numbers of steelhead passing VAFS decreasing to less than 1,000 adults. Recent counts range from 166 (2010/11) to 935 fish (2012/13) adult steelhead, with an average around 250 to 300 adults (S. Harris, personal

communication 2013). Currently, only 1.3 miles of habitat is accessible for this steelhead population due to the construction of Scott Dam

Limited data is available for the summer-run steelhead population in the Upper Eel River. Data collection of summer-run steelhead and passage opportunities above VAFS has been severely restricted due to operations at the facility. VAFS typically closes when the adult winter-run steelhead season is over and outmigrant trapping begins. However, the majority of summer-run steelhead were most likely lost following the construction of Scott Dam, many years prior to the 1987 passage improvements that occurred to VAFS. Jones (2000) reported a snorkel survey observation of one adult steelhead between Scott Dam and VAFS in 1985, and 19 other adults were reported by CDFW staff near the VAFS screen during that summer.

Juvenile steelhead distribution surveys have been conducted by CDFW in tributary streams that flow into Lake Pillsbury and have documented the presence of *O.mykiss* and viable steelhead habitat in these tributary streams. The degree at which this landlocked *O.mykiss* population expresses an adfluvial life history is currently unknown. Almost 100-years has passed since anadromous steelhead were blocked to habitat above Scott Dam. Two major tributaries encompass the majority of the watershed that drains into Lake Pillsbury: mainstem Eel River and the Rice Fork. Minor tributaries include Salmon Creek, Smokehouse Creek and a few other smaller tributaries. Habitat typing and associated stock assessment surveys conducted in 2009 documented the presence of juvenile *O. mykiss* in most tributaries, and the upper reaches of the Eel River.

Virtually all steelhead habitat within the Upper Mainstem Eel River steelhead population exists above Scott Dam. Tributaries to the Eel River such as Rattlesnake, Trout, and Corbin creeks are reported to have good salmonid habitat conditions (Becker and Reining 2009). The Rice Fork also has tributaries that provide spawning and rearing habitat, but are lower gradient and warmer which has most likely caused an increase in Sacramento pikeminnow (*Ptychocheilus grandis*) in most tributaries and mainstem reaches of the Rice Fork. Past stream surveys by CDFW report medium to low quality habitat in Rice Fork, and Bear, Rock, and Willow creeks.

History of Land Use

Land use activities in the Upper Mainstem Eel River include timber harvest, recreation, limited livestock operations, and rural residential development. The Potter Valley Project's Cape Horn Dam and egg collecting station was completed by Snow Mountain Power and Water Company in 1908 (SEC 1998). This power and water company then completed Scott Dam in 1922 and sold the project including the Cape Horn Dam/Egg Station and diversion facility to Pacific Gas and

Electric Company (PG&E) in 1930. These dams represent the most significant Upper Mainstem Eel River salmonid habitat alterations and resulted in the loss of most of the historic habitat for Upper Eel River Chinook salmon and steelhead trout, likely including the summer-run steelhead population. Built without a fish ladder, Scott Dam blocks greater than 120 miles (IP-km; Spence 2012) of anadromous steelhead habitat, and the Cape Horn Dam fish ladder which provides passage to 12 miles of mainstem habitat. SEC (1998) reports that the Cape Horn Fish ladder has undergone many modifications, including 1915, 1962, and 1987 when major modifications were required as part of the Federal Energy Commission Article 40 opinion 187. However, some trap inefficiencies may still remain. For example few or no post-spawn steelhead (kelts) are reported during the trapping season.

With an approximate 75,000 acre-feet (AF) capacity, Lake Pillsbury is situated upon most of the high IP reaches present in the population area. From 1992 to 2004, up to approximately 160,000 AF of Eel River water were annually diverted into the East Fork of the Russian River for hydropower production agricultural and municipal uses. Until 2004, flows released downstream of Cape Horn Dam were approximately 3 cubic feet per second (cfs) during most of the summer. In 2004, the Federal Energy Regulatory Commission issued an order requiring PG&E to implement an instream flow regime consistent with the Reasonable and Prudent Alternative in the NMFS 2002 Biological Opinion. The new flow requirement increased the minimum Cape Horn Dam release flows and incorporated within-year and between-year flow variability. These flows provide quasi-natural flows for fall and winter migrations, spring emigrations, and in some years will provide improved summer rearing habitat in the mainstem Eel River below the VAFS (NMFS 2002). Still, between 2007-2012 the Potter Valley Project annually diverted approximately 22-percent of the estimated unimpaired flow at the point of diversion (*i.e.*, Cape Horn Dam), with an mean annual diversion of 77,000 acre-feet (P. Kubicek, PG&E, personal communication 2013).

The 1964 flood caused significant sedimentation within the Eel River and its tributaries, by filling in many pools, destroying riparian vegetation, and widening channels. Timber harvest activities were widespread and resulted in sediment transport into stream channels. The preponderance of unstable landforms, high road densities, and past timber harvest has contributed to the poor habitat quality evident throughout the Eel River watershed.

In 1980, piscivorous Sacramento pikeminnow were introduced into Lake Pillsbury (CDFG 1997), and now occupy the entirety of the Eel River basin's accessible habitat. This predator thrives in the warmer, slower velocity waters created by the Potter Valley Project, and has adapted well to most portions of the greater Eel River drainage. It is thought that the highest densities of pikeminnow exist within Lake Pillsbury and within the Potter Valley Project. Recent surveys by the CDFW reports, Sacramento pikeminnow are present in large numbers in Lake Pillsbury, and

many of the larger tributaries that drain into the lake, primarily the mainstem Eel River and Rice Fork (S. Harris, personal communication, 2013).

Current Resources and Land Management

The Upper Eel River watershed above Scott Dam encompasses an area of 289 square miles, roughly 7.3 percent of the Eel River's total 3,971 square mile watershed. Eighty-nine percent of the land is owned and managed by the United States Forest Service (USFS) Mendocino National Forest, and the remaining is private with a very small (<100 acres) area owned by the State. The USFS manages the majority of the watershed in the Upper Eel River under the Land and Resource Management Plan (LRMP) for the Mendocino National Forest. Private lands are characterized by large ranches, and smaller private ownerships that are developed around Lake Pillsbury.

Salmonid Viability and Habitat Conditions

The following habitat indicators were rated Poor through the CAP process: Passage and migration for the adult and smolt life stages for summer and winter run populations. Reduced density for spawners was rated poor due to the loss of habitat accessibility at Scott Dam. Loss in spatial structure for juvenile distribution was also rated poor due to the passage impairment that the dam has caused. Habitat conditions that rated poor included LWD frequency, shelter rating, primary pool frequency, and pool riffle ratio for adults and juvenile life stages. Gravel embeddedness was rated poor for the egg life stage and food production for juvenile fish. The only indicator for watershed process that was rated as poor through the CAP analysis was road density within riparian areas. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes. Indicators that were rated as Fair through the CAP process, but are considered important within specific areas of the watershed include baseflow, canopy cover, and toxicity of tributary streams during the juvenile rearing period.

Current Conditions

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

Population and Habitat Conditions

Passage/Migration: Mouth or Confluence and Physical Barriers

Scott Dam currently blocks access to 99 percent of the potential habitat available to this steelhead population (Spence *et al.* 2012). Steelhead have not had access to this habitat since 1922. Lake

Pillsbury currently maintains habitat for non-native species of Sacramento pikeminnow and largemouth bass (*Micropterus salmoides*). The reservoir provides habitat for these non-native species to survive and maintain high densities in the larger streams that drain into Lake Pillsbury. In addition, the hydrology, and sediment transport to the mainstem Eel River is disrupted by this facility. The genetic diversity of *O.mykiss* that remained above the lake has likely been altered by hatchery trout planting that has occurred since the 1930s. The extent of the impact to the native population in the Upper Eel River is unknown at this time.

Habitat Complexity: Large Wood and Shelter

Suitable shelter ratings are required for juvenile salmonids as well as adult spawners for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. Stream surveys conducted in the 1990s by CDFG indicate shelter ratings throughout the Upper Eel River, Rice Fork and its tributaries have Poor to Fair quality habitat.

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

The frequency of primary pools is poor in main reaches of the Eel River and the Rice Fork due to sediment aggradation caused by the presence of Lake Pillsbury. USEPA (2004) summarizes the sediment conditions as adverse for salmonids due to the combined effects of the 1964 flood and past land use practices. Poor conditions for salmonid survival include high coarse and fine sediment loads and pool filling in lower gradient response reaches that normally provide the most productive spawning and rearing habitat.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Spawning habitat quality is poor in most tributaries due to road related and chronic mass wasting from slides that occur in the basin. There are over 175 miles of trails (including 100 miles of off-highway vehicle trails), 760 miles of roads, and 3900 road/stream crossings in the Lake Pillsbury Hydrologic Unit (USEPA 2004). While some recovery from large sediment pulses from the 1955 and 1964 flood events has occurred, road systems, high natural erosion rates, and existing slides result in high sediment loads to tributaries draining into Lake Pillsbury.

Other Current Conditions

Summer water temperature may be limiting rainbow/steelhead survival in some tributaries of the Lake Pillsbury sub-basin, such as the lower reaches of the Eel River, and Rice Fork. However, some of the tributaries to the Rice Fork are reported to have moderately suitable rearing conditions for salmonids, and it is unknown how *O. mykiss currently* utilize the coldwater zone of Lake Pillsbury. Altered riparian canopy received a Fair rating due to the recovery that has occurred from past land use and natural events such as the 1964 flood.

Water diversion from large illegal cannabis cultivators and associated rural residential water user is likely further reducing summer base flow in some tributaries where flows are naturally low in the summer due to the warmer physical setting of the interior Middle Fork Eel River watershed. Additional stress of surface flow diversions and groundwater reductions from increased cannabis production and rural residential use is likely a moderate contributor in limiting *O. mykiss* production in this watershed unless properly regulated in the future.

In addition, it is likely that years of hatchery rainbow trout plantings in Lake Pillsbury and Rice Fork have led to a reduction in genetic integrity of native origin *O. mykiss* above Scott Dam. Impacts from Sacramento pikeminnow competition and predation are an ongoing problem in the Eel River up to the Bloody Rock area and in the Rice Fork (S. Harris, personal communication 2012).

Threats

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

Water Diversion and Impoundments

Water diversions and impoundments remain a threat to adult and juvenile steelhead primarily due to the existence of Scott Dam and associated operations of the Potter Valley Project. Efforts continue to optimize conditions downstream of Scott Dam with the use of blockwater and manipulations of water temperatures to provide timely habitat conditions. Other components of the Potter Valley Project need further investigation. For example, better understanding of Lake Pillsbury water quality dynamics, particularly temperature and dissolved oxygen, may offer better operational scenarios for rearing juvenile steelhead in the future. This threat to recovery is expected to continue in the future, however, re-examination of the Potter Valley Project will officially start in 2017 as part of the FERC relicensing process.

Other potential water diversion and impoundment threats to this steelhead population include cannabis cultivation and rural residential water diversions associated with private land holdings in and around the Potter Valley Project. Specifically, cannabis activities in the Salmon Creek and Rice Fork watersheds are believed to reduce summer surface flows that provide rearing habitat for juvenile salmonids. Ongoing and illegal cannabis operations in the Mendocino

National Forest also negatively impact surface flow to the Eel River and its tributaries in the summer months.

Roads and Railroads

Roads and trails on the USFS and some private lands continue to cause increased sediment production in this watershed. Road related debris slides, road related gullying, surface erosion, and sediment from stream crossing are the primary sources of the anthropogenic sediment delivery (USEPA 2004). These sediment sources continue to reduce salmonid habitat suitability by delivering fine sediment to spawning and rearing reaches.

Other Threats

Other threats that continue to cause sources of stress to salmonid habitat include predation and competition, fire and fuel suppression, severe weather patterns, and water diversions associated with rural residential development and cannabis production.

The introduction of pikeminnow in the 1980s from Lake Pillsbury into the Eel River system continues to result in predation of juveniles salmonids that are produced in the Upper Eel River watershed. Quantitative information is not available regarding the effects of predation and competition on abundance of juvenile rainbow trout/steelhead in the Eel River and tributaries draining into Lake Pillsbury. A high threat level was assigned for the effects of loss in abundance and competition that these non-native species present to juvenile life stages of rainbow/ steelhead that persist in the basin.

Fire and fuel management associated with high fuel loads exist in the some parts of the USFS and some private land. Due to past fire suppression actions, the watershed had the potential for large scale, high intensity, stand replacing wildfires that can then result in increased sediment delivery to stream channels (USFS and USBLM 1994). Since the late 1990s, the USFS has implemented prescribed burning and mechanical methods to reduce the potential for high intensity fires. We rated fire management as a Medium threat in this watershed for all life stages except eggs that are vulnerable to fine sediment delivery from large fires.

Large flood events and drought are the greatest threat to this highly erosive watershed. Past flood events in 1955 and 1964 have had devastating effects to salmonid habitat by filling pools that are required in the summer for both adults and juvenile steelhead. These floods have also reduced canopy levels further impacting suitability stream temperatures for rearing juvenile salmonids. Future drought conditions can reduce migration potential for both winter and summer spawners (if passage was provided at Scott Dam) and reduce suitability of stream temperatures in the spring and summer through reductions in snowpack and subsequent runoff.

The future threat of severe weather patterns was rated as a high threat overall to life stages and watershed processes, due to the high erosion potential and road density in this basin.

Cannabis production is a serious and growing threat in this watershed and other watersheds in this area. In the Outlet Creek watershed which has similar cannabis production issues, LeDoux-Bloom and Downie (2008) documented that diversion from large grow operations resulted in dry channels, stranded or dead juvenile salmonids, and a reduction in migration due to these impacts. During 2010 summer steelhead surveys in the Middle Fork Eel River, CDFG biologists noted increased cannabis operations (S. Harris, personal communication 2010), and biologists conducting field surveys in the Black Butte River report similar activities (L. Morgan, personal communication 2011). These large (thousands of plants) illegal grow operations require water diversions to supply plants during the summer growing season. This threat is likely to continue and become an increased source of stress on baseflow and water quality for juvenile salmonids over the next decade.

The USFS fuels reduction and timber harvesting is likely to continue, but these actions are generally limited in size and represent a very small percentage of the watershed. These timber harvest activities are also much improved from past practices that led to unstable slopes and reduced LWD recruitment, therefore, the threat of future timber harvesting in this watershed was rated as Low.

Limiting Stresses, Life Stages, and Habitats

Threat and stress analysis within the CAP workbook suggests adult and juvenile passage is likely limiting steelhead recovery in the Upper Eel River watershed. Almost 100 years of passage obstruction to nearly 200 miles of potential steelhead habitat is the most obvious limiting factor for this population. Secondary to this impact are the ongoing effects of non-native fish competition and predation, effects to the hydrology, and sediment transport, and degradation of habitat from roads and past logging practices.

General Recovery Strategy

In general, recovery strategies will focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Improve Passage and Migration

The Upper Mainstem Eel River steelhead population was once the longest-migrating population in the entire DPS. Restoring access to historical habitat above Scott Dam is essential to recovering this population. Providing access above Scott Dam will require extensive scientific investigations and careful planning regarding the feasibility, engineering strategy, and biological merit of such an endeavor. However, achieving the recovery of this steelhead population will increase the spatial structure (environmental/habitat variation) and diversity (phenotypic/life history types) of the greater Eel River steelhead population and ultimately the NC steelhead DPS in the face of long-term environmental change. For example, coastal summer-run steelhead appear to be derived from local winter steelhead populations, which might retain a genetic legacy that would support re-expression of summer-run steelhead phenotype. However, demonstration of this re-expression would require restoration of suitable habitat conditions (Bjorkstedt et al. 2005; Spence et al. 2008) within the historical habitat area above Scott Dam. In this example, summer-run steelhead represent the most sensitive steelhead life-history type in the Eel River basin and the potential re-expression of this life-history type in Upper Mainstem Eel River steelhead population is almost certain to contribute to other winter and summer run steelhead populations elsewhere in the Eel River watershed (e.g., North Fork Eel River, Middle fork Eel River, Soda Creek, etc.).

The historical dependency on upper Eel River water diverted to Potter Valley and the Russian River presents significant issues relative to any changes to Potter Valley Project infrastructure that would conceivably provide steelhead access to historical habitat above Scott Dam. Potential solutions to these issues may reside with improving local runoff water storage reliability in Lake Mendocino. Ongoing efforts to improve reliability of Lake Mendocino water storage includes: enhanced forecast informed reservoir operations; changes to streamflow release strategies per the Russian River Biological Opinion (2008); changes to the Russian River hydrologic index, and storage capacity within Lake Mendocino by raising Coyote Dam as originally designed. Successful implementation of these strategies and other alternative water conservation measures could alleviate or minimize out-of-basin water supply dependency on upper Eel River water. Additionally, investigations would need to determine how to operate VAFS if viable habitat were to become accessible to steelhead above and within Lake Pillsbury. Moreover, if these investigations or other potential solutions showed that Potter Valley and Lake Mendocino could rely more heavily on local runoff, then preferred strategies to provide habitat accessibility above Scott Dam might be more attainable. Other biological and ecological investigations would also need to be conducted above Scott Dam in efforts to quantify the extent of habitat quantity and quality and to address issues associated with invasive species that reside in Lake Pillsbury.

Reduce the Effects of Severe Weather Patterns

The impacts of large storm events in the past have been exacerbated by roads and timber harvest that were not sensitive to the highly erosive nature of the watershed. The strategy for reducing

the potential for mass wasting in this watershed is to upgrade and decommission roads and to avoid unstable areas when proposing timber harvest activities.

Reduce Sediment Delivery from Road Systems

Many of the road systems on USFS lands, private timberlands, and tribal lands need to be upgraded or decommissioned. Road upgrades and stream crossing repair throughout the watershed will reduce fine sediment delivery to streams and reduce the probability of triggering large landslides. As discussed above, the frequency of severe weather patterns is expected to increase, and, therefore, roads in this basin must be disconnected from the stream network or decommissioned to provide resiliency to large flood events that have had devastating effects to salmonid habitat in the past.

Increase Instream Shelter Ratings and Pool Frequency

Improvement in shelter conditions in most stream reaches in the upper Eel River, Rice Fork and tributaries is needed. Due largely to past aggradation, and absence of LWD, quality pool habitat is reduced and shelter components are comprised mainly of cobble and boulder. Restoration efforts should focus on protection of large conifers and riparian areas for future recruitment of LWD to improve shelter, and sediment reduction to improve pool frequency. Restoration efforts would need to occur in tributaries not inundated by Lake Pillsbury, and then focus work on restoring low gradient reaches exposed if dam removal occurs.

Address Water Diversion and Toxic Materials

Reduced flow conditions, and disconnected flow conditions (dry stream channels), water diversions and groundwater pumping must be minimized to protect and increase juvenile steelhead survival. Federal, state and local government representatives should work with landowners to implement creative solutions that minimize these effects; these solutions should examine conservation methods, water management planning, and water storage and recharge solutions in the rural residential areas around Lake Pillsbury. In addition, improved coordination between NMFS, CDFW, USBLM, and USFS and county law enforcement agencies must be implemented to reduce the number of illegal stream diversions within this basin. Additional law enforcement actions to reduce illegal water diversions are expected to reduce the level of toxic materials entering surface waters from cannabis operations. Funding must also be provided for the cleanup of cannabis production sites to minimize future release of toxic material into stream channels.

Improve Migration Barriers

Support USFS staff biologist recommendations regarding migration issues for upstream passage of rainbow/steelhead into rearing habitat of Horse, Trout and Corbin creeks. These barriers

documented in the Fish Passage Assessment database should be investigated to determine the potential to improve or restore passage to to headwater reaches of this basin.

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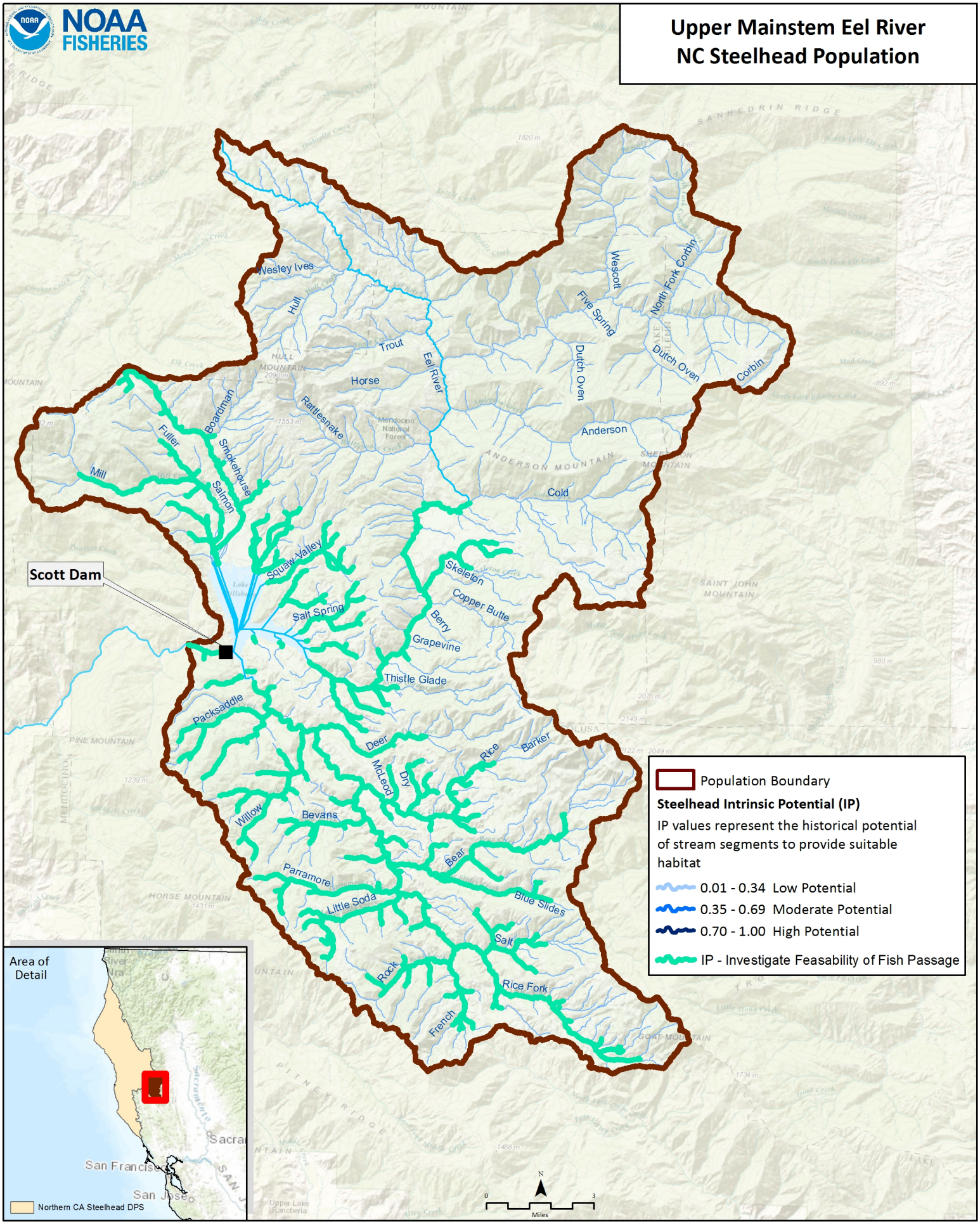
NOAA FISHERIES
Upper Mainstem Eel River
NC Steelhead Population
Scott Dam
Wesley Ives
Hull
Trout
Horse
Eel River
Rattlesnake
Boardman
Fuller
Smokehouse
Mill
Salmon
Squaw Valley
Salt Spring
Skeleton
Copper Butte
Berry
Grapevine
Thistle Glade
Packsaddle
Deer
McLeod
Dry
Rice
Barker
Willow
Bevans
Bear
Parramore
Little Soda
Blue Slides
Salt
Rock
Rice Fork
French
Wescott
Five Spring
North Fork Corbin
Dutch Oven
Dutch Oven
Corbin
Anderson
Cold
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Investigate Feasability of Fish Passage
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
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% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<5% of IP-Km or <16 IP-Km accessible*	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawners per IP-Km	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		<1 spawners per IP-Km	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-Km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Fair
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >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	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	<50% 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 Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	38% streams/20% IP-Km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-Km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.5 Diversions/10 IP km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	<1466	1,466-146,666	>146,666		Poor	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good

			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.4 Miles/Square Mile	Fair
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	1.1 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	Use Flow Protocol; Fill out Current Indicator NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor

		Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
		Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Fair
		Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
		Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
		Water Quality	Mainstem Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
		Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
		Size	Viability	Abundance				No Population - possible adfluvial	Poor

Upper Eel River CAP Threat Results

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

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UMER-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
UMER-NCSW-3.1.1.1	Action Step	Hydrology	Restore unimpaired flows and access to historical spawning and rearing areas though provide off stream stoage, conservation and potenital water lease or acquisitions.	1	10	CDFW, FERC, NMFS, PG&E, USFS	32.50	32.50				65	Cost based on stream flow/precipitation model at a rate of $65,084/project. Additional cost likely to incur for methods to restore unimpaired flows such as water conservation, storage, or water lease/acquisition.
UMER-NCSW-3.1.1.2	Action Step	Hydrology	Investigate and modify operations at the Van Arsdale Fish Station, as appropreiae, while considering passage alternatives at Scott Dam.	2	5	CDFW, FERC, NMFS, PG&E, Private Consultants						0	Action is considered In-Kind
UMER-NCSW-3.1.1.3	Action Step	Hydrology	Investigate the effectiveness of "block water" releases from Scott Dam.	2	5	CDFW, FERC, NMFS, PG&E						0	Action is considered In-Kind
UMER-NCSW-3.1.1.4	Action Step	Hydrology	Install flow gages at above Lake Pillsbury on the Eel River and the Rice Fork.	2	5	FERC, NMFS, PG&E, USFS	3.00					3	Cost based on installing a minimum of 3 stream flow gauges at a rate of $1,000/gauge. Cost does not account for data management or maintenance.
UMER-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
UMER-NCSW-5.1.1.1	Action Step	Passage	Provide passage over physical barriers that preclude steelhead from accessing important habitat areas above the Bloody Rock high gradient reach on the Eel River.	1	10		1,279	1,279				2,557	Cost based on providing passage at 2 dams (assume partial barrier) and 4 road crossings (total barriers) at a rate of $532,706 and $372,894/project, respectively.
UMER-NCSW-5.1.1.2	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Horse and Trout creeks, and the Upper eel River along the USFS M6 road.	1	5	AC Alliance	3,500					3,500	Cost based on providing passage at 3 road crossings (assume total barrier on forested road) at a rate of $85,232/project. (Cost revised based on comments from the Mendocino National Forest, to address 1 bridge replacement and two bottomless arches).
UMER-NCSW-5.1.1.3	Action Step	Passage	Determine the quantity and quality of historic habitat above Scott Dam, including conditions within Lake Pillsbury.	2	3	CDFW, NMFS, Private Landowners, USFS	115.00					115	Cost based on fish/habitat restoration model at a rate of $114,861/project.
UMER-NCSW-5.1.1.4	Action Step	Passage	Investigate the current condition and structural integrity of Scott Dam.	2	3	CDFW, FERC, NMFS, PG&E						0	Action is considered In-Kind
UMER-NCSW-5.1.1.5	Action Step	Passage	Investigate the feasibility of decommissioning and removal of Scott Dam.	1	5	CDFW, FERC, NMFS, PG&E						TBD	
UMER-NCSW-5.1.1.6	Action Step	Passage	Following physical and biological investigations associated with passage over Scott Dam, provide passage recommendations for the recovery of the Upper Mainstem Eel River steelhead population.	1	5	CDFW, FERC, NMFS, PG&E, USFS						TBD	
UMER-NCSW-5.1.1.7	Action Step	Passage	If determined feasible, implement passage recommendations specifically targeting the recovery of the Upper Mainstem Eel River steelhead population.	1	5	CDFW, FERC, NMFS, PG&E, USFS						TBD	
UMER-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UMER-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
UMER-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a plan or priority list that identifies specific stream reaches that would be suitable for conducting instream habitat complexity projects.	2	3	CDFW, NMFS, NOAA RC, PG&E, Private Landowners, USFS	115.00					115	Cost based on fish/habitat restoration model at a rate of $114,861/project.
UMER-NCSW-6.1.1.2	Action Step	Habitat Complexity	Implement a large woody debris or other large roughness elements supplementation program to increase stream complexity to improve pool frequency and depth.	2	10	CDFW, NOAA RC, USFS	598	598				1,196	Cost based on treating 46 miles (assume 1 project/mile in 50% high IP) at a rate of $26,000/mile. (Cost estimate revised based on comments from the Mendocino National Forest)
UMER-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners (private, USFS, and PG&E) to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	1	20	CDFW, Private Landowners, USFS						0	Action is considered In-Kind
UMER-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover										
UMER-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	2		CDFW, Mendocino County RCD, NMFS, Private Landowners, USFS						TBD	Cost based on amount of conservation measures to employ, fair market value, and landowner participation.
UMER-NCSW-7.1.1.2	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	2	50	CalFire, CDFW, County of Mendocino, NMFS, PG&E, Private Landowners, USFS						0	Action is considered In-Kind, as these recovery partners have responsibility and authority to address this action.
UMER-NCSW-7.1.1.3	Action Step	Riparian	Prioritize and fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	10	CDFW, Mendocino County RCD, NRCS, Private Landowners, USGS	46.00	46.00				92	Cost based on treating 4.8 miles (assume 1 project/mile in 5% high IP) at a rate of $3.63/ft.
UMER-NCSW-7.1.1.4	Action Step	Riparian	Develop a riparian restoration plan for tributaries draining into Lake Pillsbury and include restoration of the areas that would be exposed if Scott Dam is decommissioned and removed.	2	3	CDFW, NMFS, PG&E, Private Consultants, Private Landowners	74.00					74	Cost based on riparian restoration model at a rate of $73,792/project.
UMER-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
UMER-NCSW-8.1.1.1	Action Step	Sediment	Investigate the potential effects of sediment transport on stream reaches above, within and below Lake Pillsbury as a consequence of decommissioning and removing Scott Dam	2	3	CDFW, FERC, NMFS, PG&E, Private Consultants, USFS	100.00					100	Rough estimate
UMER-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UMER-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity										
UMER-NCSW-11.1.1.1	Action Step	Viability	Expand salmonids and pikeminnow monitoring within and around the PVP area; including, juvenile outmigrant sampling around VAFS	2	10	CDFW, FERC, NMFS, PG&E							Costs for spawning ground surveys are accounted for in the Monitoring Chapter
UMER-NCSW-11.1.1.2	Action Step	Viability	Continue monitoring of adult and juvenile steelhead at the Van Arsdale Fish Station. Explore the need to extend the operations of VAFS to monitor summer steelhead.	2	10	CDFW, FERC, NMFS, PG&E						0	Action is considered In-Kind
UMER-NCSW-11.1.1.3	Action Step	Viability	Conduct spawning surveys to determine habitat use above the Van Arsdale Fish station. Include the assessment of conditions for summer steelhead in this work.	3	10	CDFW, FERC, NMFS, PG&E, Private Landowners							Costs for spawning ground surveys are accounted for in the Monitoring Chapter
UMER-NCSW-11.1.1.4	Action Step	Viability	Investigate juvenile steelhead migratory patterns through the Van Arsdale diversion facility. consider utilizing radio telemetry equipment to conduct study.	3	3	CDFW, NMFS, PG&E	225.00					225	Cost based on adult escapement and juvenile migration at a rate of $36,379 and $188,264/project, respectively.
UMER-NCSW-11.1.1.5	Action Step	Viability	Analyze existing tissue samples collected in drainage basins above Scott Dam to assess existing genetic structure of an adfluvial steelhead population.	2	3	CDFW, NOAA SWFSC, PG&E						0	This action is largely already being conducted. Action is considered In-Kind
UMER-NCSW-14.1	**Objective**	**Disease/ Predation /Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-14.1.1	Recovery Action	Disease/ Predation /Competition	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
UMER-NCSW-14.1.1.1	Action Step	Disease/ Predation /Competition	Reduce predation and competition of pikeminnow on juvenile steelhead by removing/reducing pikeminnow populations	2	20	CDFW, NMFS, PG&E						TBD	Cost based on amount of predatory fish species to be removed. Cost for pikeminnow eradication estimated at $9.38/fish.
UMER-NCSW-14.1.1.2	Action Step	Disease/ Predation /Competition	Support investigations that determine the most effective methods to control the pikeminnow population.	2	5	CDFW, FERC, NMFS, PG&E						TBD	Cost accounted for in above action step.
UMER-NCSW-14.1.1.3	Action Step	Disease/ Predation /Competition	Implement the most cost effective methods or programs of pikeminnow control in the Upper Eel River watershed.	2	10	CDFW, PG&E						TBD	
UMER-NCSW-14.1.1.4	Action Step	Disease/ Predation /Competition	In coordination with the investigation to decommission and remove Scott Dam, develop alternatives to eradicate non- native fish from Lake Pillsbury.	2	3	CDFW, FERC, NMFS, PG&E						TBD	
UMER-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										
UMER-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
UMER-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations to aide in managing forest fuel loads in a manner consistent with historical parameters.	3	3	CalFire, Private Landowners, USFS	25.00					25	
UMER-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Work with private landowners to reduce fuel loads in the Upper Mainstem Eel River watershed.	2	25	CalFire, Private Landowners, RWQCB						0	Action is considered In-Kind
UMER-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Work with USFS to reduce fuel loads in the Mendocino National Forest.	2	30	NMFS, USFS						0	Action is considered In-Kind
UMER-NCSW-16.1	**Objective**	**Fishing/Collectin g**	**Address the inadequacy of existing regulatory mechanisms**										
UMER-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										

Upper Mainstem Eel River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UMER-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead by increasing law enforcement.	3	10	CDFW Law Enforcement, NMFS OLE, USFS	100.00	100.00				200	
UMER-NCSW-16.1.1.2	Action Step	Fishing/Collecting	Work CDFW to minimize or curtail trout fishing in tributaries that drain into Lake Pillsbury.	3	20	CDFW, NMFS, USFS						0	Action is considered In-Kind
UMER-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
UMER-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CDFW, NMFS, Private Landowners, RWQCB, USFS						TBD	No estimate at this time.
UMER-NCSW-23.1.1.2	Action Step	Roads/Railroads	Implement road upgrades at high priority sites or systems.	2	20	CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners, USFS	536	536	536	536		2,142	Cost based on upgrading 102 miles of road at a rate of $21,000/mile. Cost likely to be less if high priority sites are less than 102 miles of road network. Some costs may be accounted for in other actions.
UMER-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade USFS roads that are used for public or administrative use. Decommission roads in the Mendocino National Forest based on USFS prioritization.	1	10	CDFW, NMFS, RWQCB, USFS	2,500	2,500				5,000	This estimate based on DFG and USFS rough estimates. (Cost estimates revised based on comments from the Mendocino National Forest).
UMER-NCSW-23.1.1.4	Action Step	Roads/Railroads	Work with the Lake and Glenn County DOTs to upgrade existing high priority riparian road segments.	2		County of Mendocino, CDFW, NMFS						400	Estimate 20 miles at 20k
UMER-NCSW-23.1.1.5	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority roads, or those identified in a sediment reduction plan.	2	10	CDFW, NMFS, Private Landowners	400.00	400.00				800	Estimate 40 miles at 20k
UMER-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UMER-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to watershed hydrology										
UMER-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Investigate the benefits of increasing the storage of Coyote Valley Dam to reduce the need for Scott Dam and improve the historic flow regime and habitat availability in the upper mainstem Eel River..	2	3	CDFW, Corps, MCRRFCD, NMFS, Sonoma County Water Agency	100.00					100	rough estimate

Van Duzen River Population

NC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 6,200 adults
- Current Intrinsic Potential: 312.2 IP-km

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 two natural barriers on the mainstem of the Van Duzen River that limit passage of adult steelhead (CDFG 2012a). Salmon Falls, at River Mile 36.7 near the confluence of Bloody Run Creek, and Eaton Roughs located at River Mile 46. Adult steelhead are able to pass Salmon Falls under most conditions but are generally unable to pass Eaton Roughs in most years. Much of the Little Van Duzen River is accessible to steelhead as well.

There are limited, inconclusive data documenting winter steelhead abundance in the Van Duzen River (CDFG 2012b). Anglers self-report catch and release of wild steelhead using the Steelhead Report Card. The number of wild adults released from 2000 to 2006 was below 100 each year; from 2007-2010 the number has generally increased and ranged from 180 to 403 (Table 1; Farhat Bajjaliya, CDFW pers. comm. 1/23/2015). The proportion of fish caught that were summer steelhead vs. winter steelhead is unknown. The number of adult steelhead observed during a 20-mile survey of steelhead holding pools on the Van Duzen River from Eaton Roughs to Little Larabee Creek has varied since 1979. From 2011 to 2014 (next most recent year was 1997), counts have been between 81 and 255 adults with the peak in 2012, and averaged 152 fish per year (Table 2) (Shaun Thompson, CDFW, pers. comm. 1/22/2015). These numbers are much lower than estimates of over 2,000 fish in the Little Van Duzen alone prior to the 1964 flood (CDFG 2012a).

History of Land Use

Historically, the Van Duzen River basin consisted primarily of late-seral redwood/Douglas-fir (coniferous) forests with limited open oak woodland/prairies farther inland at higher elevations. Beginning near the turn of the twentieth century, logging led to development of hardwood-dominated forests and reduced large wood recruitment potential to streams (CDFG 2012a). In

addition, floodplain and estuarine wetland areas were cleared, diked, and drained to provide land for agriculture and urban development. Technological developments after World War II enabled logging and road building in steeper, more landslide prone areas. This caused excessive sediment delivery to streams, especially following large floods in 1955 and 1964, resulting in shallow pools and wide streams. Sacramento pikeminnow (*Ptychocheilus grandis*) were accidentally introduced to Lake Pillsbury in 1980 (CDFG 1997), and are presumed to have colonized all accessible reaches of the Eel River watershed. Past gravel mining in the Lower Eel River likely contributed to braiding and flattening of the Eel River between the confluence with the Van Duzen River to one mile downstream of Fernbridge (Humboldt County Department of Public Works 1992).

Rural residences, small ranches, and agriculture have increased the demand for water. Currently, much of this demand is accommodated through instream diversions or shallow wells, which have lowered streamflows during summer low-flow periods.

Current Resources and Land Management

About 18 percent of the Van Duzen River basin is under Federal ownership, and the remaining 82 percent is owned by private entities. Of this 82 percent, 15 large ranches make up 30 percent of the land, industrial timberlands make up 27 percent, and small private rural developments make up 25 percent (CDFG 2012a).

Several watershed groups are active in the basin: the Eel River Watershed Improvement Group, Friends of the Eel River, Friends of the Van Duzen River, and the Yager/Van Duzen Environmental Stewards. NMFS considered the following existing management plans and other documents, which identify actions to improve conditions in the Van Duzen River basin, during preparation of this document.

- Recovery Strategy for California CCC Coho Salmon (CDFG 2004);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997);
- Van Duzen Basin Assessment Report (CDFG 2012a);
- Lower Eel River Watershed Assessment (CDFG 2010);
- Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment (USEPA 1999);
- Lower Eel River Total Maximum Daily Loads for Temperature and Sediment (USEPA 2007);
- Green Diamond Resource Company (GDRC) Habitat Conservation Plan (GDRC 2006);
- Humboldt Redwood Company Habitat Conservation Plan (HRC 2012); and
- Yager-Lawrence Watershed Analysis (HRC 2009).

Steelhead Viability and Watershed Conditions

NMFS rated the following indicators as Poor for steelhead through the CAP process (see Van Duzen CAP results): Passage flows at the confluence with the Eel River, quality and extent of estuary habitat, canopy cover, primary and staging pools, baseflow, diversions, gravel quality, quantity, and distribution, gravel embeddedness, shelter, turbidity, extent of timber harvest, road density, and streamside road density. Other indicators that warrant habitat restoration because they were rated "Fair" are: frequency of large wood, the ratio of pools to riffles and flatwater, size of riparian trees (tree diameter), spawning gravels, floodplain connectivity, toxicity, population density, redd scour, instantaneous flow conditions, passage flows, passage at the mouth for smolts, floodplain connectivity, water temperature, and abundance of smolts and summer steelhead adults.

The recovery strategy focuses on improving the habitat conditions described by these indicators. Strategies that address other indicators are developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion elaborates on those conditions that rated Fair or Poor in our CAP viability analysis. The Van Duzen River CAP Viability Table results are described below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Unless otherwise noted, conditions are assessed in all areas utilized by steelhead in the Van Duzen River, including the lower Eel River downstream of the confluence with Van Duzen River and the Eel River estuary.

Sediment: Gravel Quality and Distribution of Spawning Gravels

The EPA listed the Van Duzen River and the Lower Eel rivers as impaired by sediment (USEPA 1999 and 2007). The Eel River is one of the most erodible watersheds in the United States (Brown and Ritter 1971) because of the active tectonic setting, highly erodible soils, and high precipitation. The Eel River carries 15 times as much sediment as the Mississippi River, and more than four times as the Colorado River (Brown and Ritter 1971). Anthropogenic activities in the Eel and Van Duzen rivers have exacerbated these naturally high sediment loads. A study of the continental shelf deposits offshore from the mouth of the Eel River indicates that there has been a sudden, three-fold increase in the rate of sedimentation since 1954 (USEPA 2007).

Fine sediment loads are very high in much of the Van Duzen (CDFG 2012a, USEPA 1999, HRC 2009) and Lower Eel rivers (CDFG 2010, USEPA 2007), leading to embedded gravels and a small average particle size. Sedimentation of spawning gravel throughout much of the Van Duzen River watershed is a limiting factor to steelhead production (CDFG 2012a).

NMFS rated sediment conditions as Poor for eggs, adult summer steelhead, and juveniles rearing in the summer and winter. Eggs may fail to hatch if excessive sediment loads keep oxygen from reaching them (CDFG 2012a). Adult summer steelhead hold in deep pools over the hot summer months; sediment reduces the depth of these pools. Juveniles and presmolts also rely on pools for shelter, and feed on insect prey produced in riffles upstream of pools. Insect production can be impaired by excess sedimentation on these riffles (CDFG 2012a). Aggradation has interrupted the connectivity of surface flow in several areas. The Van Duzen River is often isolated from the Eel River by subsurface flows in late summer and early fall, affecting movement of juvenile steelhead. An overabundance of sediment is deposited at the confluence of the Van Duzen and Eel rivers each year, which results in sub-surface flows and dry channels (CDFG 2010).

The naturally highly erosive soil in the Van Duzen watershed, combined with steep slopes and dormant landslides resulting from prior land use, leads to higher risk of shallow landslides and debris slides (CDFG 2012a). Treatment of past landslides, and prevention of future ones, is important to reduce sediment delivery to the Van Duzen River and its tributaries. Unstable banks are also sources of sediment delivery.

Habitat Complexity: Large Wood and Shelter

Surveys conducted by CDFW indicate that shelter ratings are very poor throughout the population area, with 3 percent of surveyed streams meeting desired levels for shelter and LWD (SEC 2012). Habitat complexity conditions have an overall rating of Poor for steelhead summer

rearing juveniles, winter rearing juveniles, smolts, and adult summer steelhead. Habitat complexity is reduced by a deficit of large wood and a large supply of sediment (CDFG 2012a).

Viability: Density, Abundance, and Spatial Structure

There are an estimated 3,000-5,000 adult winter steelhead in the Van Duzen River annually (S. Downie, CDFW, pers. comm. 8/3/2012). Viability conditions were Fair for winter adults, summer rearing juveniles, smolts, and adults. In order to achieve a low risk of extinction, there should be at least 6,340 steelhead adults in the Van Duzen River each year. There is no defined target number of adult summer steelhead for the Van Duzen River, but the numbers observed from 2011 to 2014 were far less than observed before the 1964 flood (CDFG 2012a).

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

Available data indicate that there are not enough suitable juvenile rearing pools or adult holding pools in the Van Duzen River (CDFG 2012a) and the Yager and Lawrence Creek watersheds of the Van Duzen River (HRC 2009). Many pools are too shallow due to excessive sediment inputs (CDFG 2012a), and those pools available for juvenile use provide insufficient number and diversity of cover elements such as undercut banks, woody debris, and root masses (SEC 2012). Pools in the Van Duzen River are often shorter than is optimal for steelhead use, likely due to excessive sediment loading (CDFG 2012a). The impacts of reduced pool volume and complexity are exacerbated by the presence of predatory Sacramento pikeminnow, which further limits the use of pools by juvenile steelhead rearing.

Water Quality: Temperature

High water temperature is common during the summer in the mainstem Van Duzen River and many of its tributaries (SEC 2011), which affects rearing juvenile steelhead (CDFG 2012a). Water temperature is also a problem in the summer in the mainstem Eel River (CDFG 2010, EPA 2007), affecting juveniles, smolts and adult summer steelhead, which all use the area for rearing and passage. The Lower Eel River is listed as temperature-impaired under section 303(d) of the Clean Water Act (EPA 2007). Water quality concerns in the Lower Eel River are further described in the profile for the South Fork Eel/Lower Eel River in this document.

Estuary: Quality and Extent

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

Riparian Vegetation: Composition, Cover & Tree Diameter

NMFS rated tree diameter as Fair overall because much of the Van Duzen River is forested with moderate-sized trees, and rated species composition as Very Good because the watershed is estimated to have 75 percent intact historical riparian species. However, many areas of the lower Eel River have poor canopy cover, which falls short of the 80 percent shade canopy target value used by CDFW (CDFG 2010) to assess habitat condition relative to the target.

Sediment Transport: Road Density

There are an average of 6.8 miles of road per square mile of land in the Van Duzen watershed, leading to a rating of Poor. Most of these roads are associated with timber harvest activities and rural residences. USEPA (2009) found that half of the human-caused sediment loading in the watershed was due to roads.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Landscape Pattern conditions have an overall rating of Poor because at least one land-disturbing activity occurs in all areas of the watershed: Road density is high across the watershed, forestry occurs over much of watershed, and ranching occurs in some areas. The impact of this disturbance is compounded by the highly erosive soil in the Van Duzen River watershed (CDFG 2012a).

Hydrology: Baseflow and Passage Flows

NMFS rated baseflow and passage flows as Poor for summer rearing juvenile and adult summer steelhead. Summer flow conditions in the mainstem Eel River are poor, and flow in the Van Duzen River in late summer is likely lower than historic conditions (*e.g.,* Figure 1). Reduced summer flows in the mainstem Eel River and the Van Duzen River can be partly attributed to increased evapotranspiration rates resulting from replacement of old-growth forests with younger forests (Perry 2007). Reduced flows also likely reflect increased water diversions to support medical marijuana cultivation (S. Bauer, CDFW, personal communication, 1/17/13). Reduced flows can result in shallower pools and increased water temperature, and can impair steelhead movement. If reaches dry up, the amount of habitat available to steelhead is reduced and passage of smolts and adults may be impaired or stopped (CDFG 2010). The poor water quality conditions resulting from low flows favor the pikeminnow, which preys upon juvenile steelhead.

Water Quality: Turbidity or Toxicity

Extended periods of high turbidity after rain events have been documented in Cummings Creek, Grizzly Creek, Wolverton Gulch, and other areas of the Van Duzen basin (CDFG 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). The Loleta wastewater treatment facility accepts both municipal wastewater and wastewater from the Humboldt Creamery and the Loleta Cheese Factory. This facility discharges into percolation/evaporation ponds on the Eel River, and in the winter, these ponds overflow into the Eel River (CDFG 2010).

Hydrology: Redd Scour

NMFS rated redd scour conditions as Fair for eggs in the Van Duzen River. CDFG (2012a) found that peak flows might be more extreme in the Van Duzen River than in past due to timber harvest and other land alterations, which may have accelerated the rate at which rainwater runs off the land. These flows can destroy steelhead redds.

Hydrology: Impervious Surfaces and Diversions and Impoundments

The proportion of the Van Duzen River watershed covered by impervious surfaces is low (SEC 2012). The number of diversions in the Van Duzen River is unknown but could be increasing due to the medical marijuana industry (see rating of threat of diversions as High). Water diversion and impoundments pose a High threat to summer rearing juvenile and adult summer steelhead.

Threats

The following discussion focuses on those threats NMFS rated High or Very High (see Van Duzen CAP Results). Recovery strategies will likely focus on ameliorating these threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts.

Unless otherwise noted, threats are assessed in all areas utilized by fish originating in the Van Duzen River, including the lower Eel River (downstream of the confluence with Van Duzen River) and the Eel River estuary.

High or Very High Rated Threats

Channel Modification

Actions that modify or disrupt the natural channel-forming processes and morphology of the Lower Eel River and its estuary have degraded habitat utilized by steelhead. Dikes and levees were constructed in the estuary in order to restrict flow and reclaim tidelands. Please see the NC

steelhead Eel River Overview for a complete discussion of this threat and associated recovery actions.

Water Diversion and Impoundments

Water diversion and impoundments pose a High threat to summer rearing juvenile and adult summer steelhead. As of July 2010, there were 25 licensed, permitted, or pending water rights within the Lower Eel basin (estuary to River Mile 21) and lower Van Duzen River (CDFG 2012a); this is not a complete number of diversions because it does not include users of riparian rights and other diversions that are not registered with the State Division of Water Rights. Diverted water is used to water row crops and home gardens, for watering cattle, and for domestic and municipal use by the cities of Fortuna and Rio Dell. Marijuana cultivation has become locally abundant in the Van Duzen River (CDFG 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). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per season (Humboldt Growers Association 2010). Diversions affect flow in the Eel River and Van Duzen River, and impact steelhead by degrading instream habitat conditions. The effects of reduced flow on steelhead are described under the stress "Hydrology: Baseflow and Passage Flows."

Disease, Predation and Competition

The invasive Sacramento pikeminnow is common in some areas of the lower Eel River basin (CDFG 2010) and is abundant in some locations of the mainstem Van Duzen River and in Yager Creek (CDFG 2012a). This species preys upon and competes with juvenile steelhead. The lifestages most affected are summer rearing juvenile steelhead, and smolts. Removal of pikeminnow has been unsuccessful in the Eel River (CDFG 2012a). Pikeminnow prefer warmer water than steelhead do (Bettelheim 2001), so reducing water temperature to match steelhead habitat requirements would make the habitat less suitable to pikeminnow and may help control the species.

Roads and Railroads

As described under the "Sediment Transport: Road Density" stress in this document, high road density in the Van Duzen River and the lower Eel River is problematic for recovery of steelhead in these areas due to its effects on watershed processes. Roads can also alter the hydrology of stream systems, resulting in higher peak flows (Ziegler *et al.* 2002).

Fishing and Collecting

Fishing is a High threat to adult summer and winter steelhead. There is a popular catch-and-release fishery targeting summer steelhead in the Eel River that attracts hundreds of anglers every

season. California sport fishing regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration. Sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1 of each year, which allows anglers to target adult summer steelhead staging in low flow conditions during September. The low flow season expires on January 31, which also leaves adults vulnerable to fishing pressure during low flows occurring on or after February 1. Adult steelhead are easy targets for anglers and poachers in these extremely low flows. Poor water quality in September stresses the fish and likely results in increased hook-and-release mortality (Clark and Gibbons 1991). Based on self-reported steelhead angling data, some of these fish are not only subject to the stress of capture and release but are removed from the system entirely; Recreational fishermen reported keeping adult wild steelhead in eight out of twelve years from 2000 to 2012 (Table 1).

Low or Medium Rated Threats

Livestock Farming and Ranching

The irreversibility of the stresses (Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater ratios; Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels) that result from this threat is generally Low, leading to an overall Medium threat rating. Cattle grazing, the predominant land use in the delta grasslands, has been a major factor in the degradation of habitat and reduced floodplain connectivity in the Lower Eel and estuary. Ongoing impacts include degradation of water quality by cattle waste and erosion of stream banks and damage to riparian vegetation where cattle have unrestricted access to streams. Diversions for livestock watering are considered in the 'Water Diversions and Impoundments' threat.

Logging and Wood Harvesting

Timber harvest is a dominant land use in the basin (CDFG 2012a). The rate of timber harvest on California's north coast has generally decreased over the last 25 years, but in the Van Duzen River basin, the acreage harvested has increased since 1990 (CDFG 2012a). Timber harvest has numerous effects on steelhead habitat, including reduced recruitment of large wood into streams, reduced instream habitat complexity, reduced shade that can lead to increased water temperature, and increased sedimentation. USEPA (1999) found that half of the anthropogenic sediment loading in the Van Duzen River was due to timber harvest. Much of the forested lands are managed under Habitat Conservation Plans held by Humboldt Redwood Company and Green Diamond Resource Company. The conservation measures in these HCPs (GDRC 2006, HRC 2012) are generally more protective of steelhead habitat than the regulations that would

otherwise apply at the time the HCPs were finalized. California's Forest Practice Rules (CFPR) regulate timber harvest on all private lands. NMFS is working collaboratively with the California Board of Forestry to limit the effects of forestry operations on threatened and endangered steelhead populations in California through the CFPR. At this time, however, the rules do not fully address the limiting factors for steelhead.

Agriculture

Agriculture as defined for this plan excludes ranching, which is a separate threat. Some row crops are planted and pasture grasses are bailed for winter feed in the lower Eel River (CDFG 2012a), and marijuana cultivation has become locally abundant in the Van Duzen River (CDFG 2012a), but aside from associated water diversions agricultural impacts are of minor impact to steelhead and their habitat. Water diversions to support this agriculture are considered under the 'Water Diversions and Impoundments' threat.

Residential and Commercial Development

Several small towns lie within the Eel River watershed downstream of the Van Duzen River, and the town of Fortuna is the population center in the area. About 12,500 people lived in this area (represented by the principal communities of Ferndale and Fortuna) when the 2004 census was conducted (CDFG 2010). Rural residences also occur elsewhere in the basin. Diversions to support these communities are considered under the 'Water Diversions and Impoundments' threat, and roads associated with these communities are considered under the 'Roads' threat, both elsewhere in this document.

Hatcheries and Aquaculture

There are currently no hatcheries or fish collecting operations in the Eel River or Van Duzen River basin. Adult steelhead originating from hatcheries elsewhere (*e.g.*, Mad River) sometimes stray to the Eel River and the Van Duzen River and are caught by recreational anglers (F. Bajjaliya, CDFG, personal communication, 7/24/12). These hatchery fish likely have a minor effect on steelhead in the Van Duzen River. Based on self-reported steelhead report card data, these hatchery fish made up from 2% to 81% of the total steelhead caught from 2000 to 2012, and hatchery fish made up at least half of the number of fish captured from 2000 to 2012 (Table 1).

Mining

Gravel extraction occurs in the Lower Eel River from the mouth upstream to Eaton Falls. These operations are conducted with State and Federal oversight. The Medium threat rating reflects sensitivity of the channel to future disturbances (*i.e.*, lack of floodplain and channel structure). Certain gravel extraction trenching methods have been used successfully to address some of the problems associated with the high sediment load in the lower Eel River, including the adult

migration barrier that develops at the Van Duzen/Eel River confluence. Current gravel mining methodologies accommodate the narrowing and deepening of channels by using wet trenching techniques.

Recreational Areas and Activities

Recreational activities such as biking, hiking, and equestrian uses occur in the Van Duzen watershed but likely have a minimal impact on steelhead habitat. In 2010, the U.S. Forest Service approved a motorized travel management plan for the Six Rivers National Forest, including land in the headwaters of the Van Duzen River (USFS 2010). This plan minimizes potential resource damage resulting from use of motorized vehicles in the national forest. Recreational fishing is considered under the "Fishing and Collecting" threat.

Severe Weather Patterns

Floods and droughts constitute a low threat to steelhead in the Van Duzen River basin and the lower Eel River areas they utilize. Sea-level rise associated with climate change is likely to affect Van Duzen River steelhead by reducing the amount of habitat available to steelhead in the Eel River estuary. The amount of sea-level rise expected to occur in the next ten years poses a low threat to steelhead.

Limiting Stresses, Lifestages, and Habitats

Juveniles and adult summer steelhead are limited by poor rearing conditions during the summer months caused by high water temperature in the lower Eel River, inadequate pools throughout the Van Duzen River and lower Eel River that do not have enough cover and are too shallow, and reduced and degraded estuarine habitat. Fine sediments negatively impact existing habitat throughout both basins. Further, water diversions reduce instream flow in the lower Eel River, exacerbating water temperature issues and limiting passage of juvenile and adult steelhead.

General Recovery Strategy

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

Restore Access to Habitat

Barriers to fish passage do not present a major impediment to restoration and recovery, as reflected by their low stress ranking. However, many tributaries to the mainstem Eel River become disconnected and inaccessible in the summer months due to sediment deposition and the resulting sub-surface flows. If the tributaries were accessible, they would provide refuge currently very limited in the Eel River mainstem reaches.

Investigate and Address Water Diversion and Groundwater Extraction and Ensure Instream Flows Are Sufficient

In the Lower Eel and Van Duzen rivers, diversions likely limit steelhead production by impeding passage and degrading habitat to the extent that fish die. Instream flows should be increased during the summer months by providing incentives to reduce diversions during the summer, establishing a forbearance program using water storage tanks to decrease diversions during periods of low flow, creating water budgets to avoid over-allocating water diversions, and ensuring that General Plan or City ordinances account for steelhead habitat needs.

Increase Habitat Complexity

Pools in the Van Duzen and Lower Eel rivers are too simplified and shallow to support steelhead growth and survival. Large wood, boulders, or other instream structure should be added (especially in areas with cool water) in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be restored in the Van Duzen River and its tributaries and in lower Eel River tributaries.

Reduce Water Temperature

High water temperatures limit growth and survival of juvenile steelhead. In streams with insufficient stream canopy, riparian vegetation should be managed to increase shade. Livestock fencing should be used to protect riparian vegetation from cattle to maintain existing shade from this vegetation. Instream flows should be sufficient so that they do not contribute to excessive water temperature.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor steelhead habitat conditions. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance that minimizes effects on steelhead habitat should be developed for building and maintenance of private roads.

Improve Fishing Regulations

The recreational fishery impacts steelhead on the Eel River, including fish headed for the Van Duzen River. The effects of this fishery on these species should be determined, and regulators should consider changes to regulations to protect this species during low flows.

Table 1: Number adult steelhead encounters reported through CDFW's Steelhead Report Card, including outcome (number kept and released) (Source: Farhat Bajjaliya, CDFW pers. comm. 1/23/15).

Year	Wild kept	Wild released	Hatchery kept	Hatchery released
2000	0	5	7	1
2001	3	5	0	34
2002	0	18	1	5
2003	2	90	3	4
2004	0	94	0	9
2005	0	43	0	0
2006	3	11	6	23
2007	3	208	1	3
2008	2	180	1	24
2009	4	256	0	37
2010	0	215	4	20
2011	0	278	2	50
2012	0	403	0	23

Table 2: Number adult steelhead observed during 20 mile survey of steelhead holding pools on the Van Duzen River from Eaton Roughs to Little Larabee Creek (Source: Shaun Thompson, CDFW, personal communication 1/22/2015).

Year	Number adult steelhead observed
1979	31
1980	25
1982	8
1984	58
1987	52
1997	15
2011	110
2012	255
2013	162
2014	81

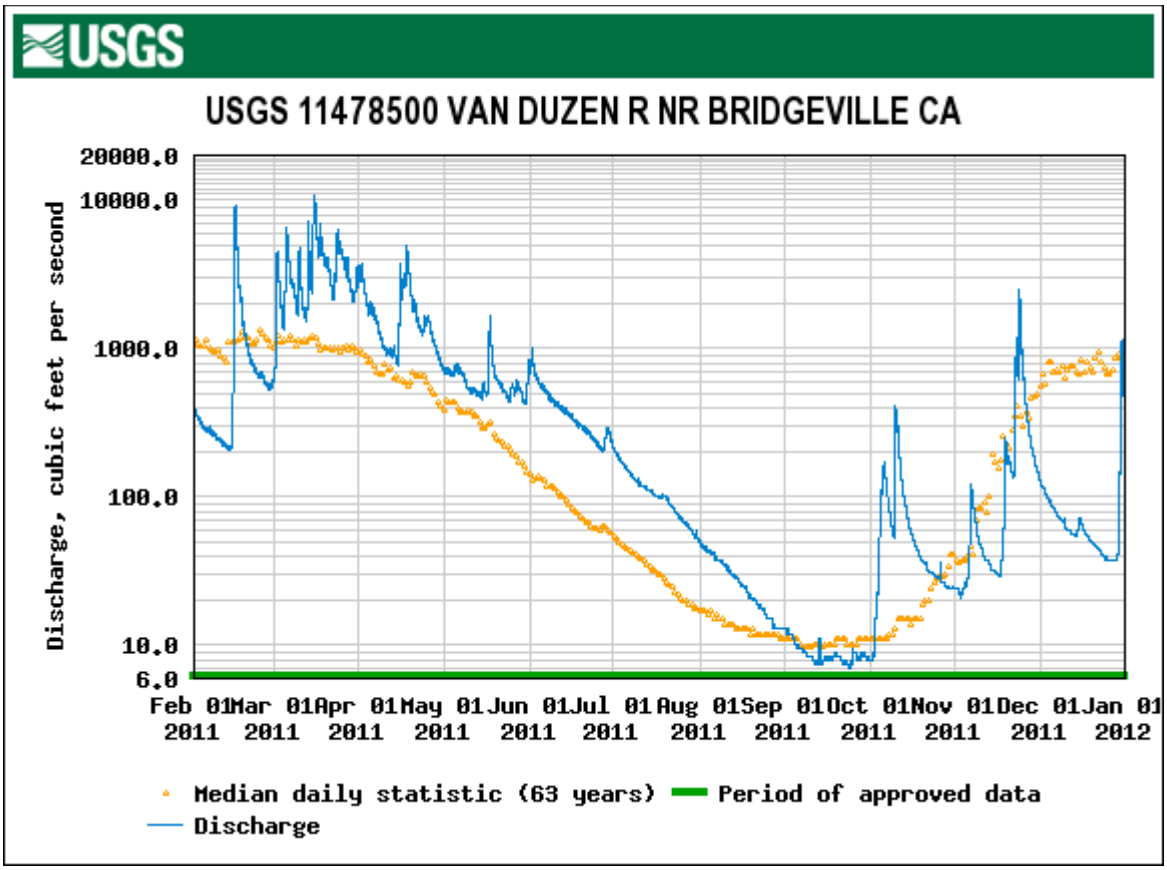

Figure 1: Daily discharge measured at USGS flow gage in Bridgeville, California in 2011, showing low flow occurring during a wet year in early- to mid-October. (Accessed 1/21/2015 from http://nwis.waterdata.usgs.gov/nwis).

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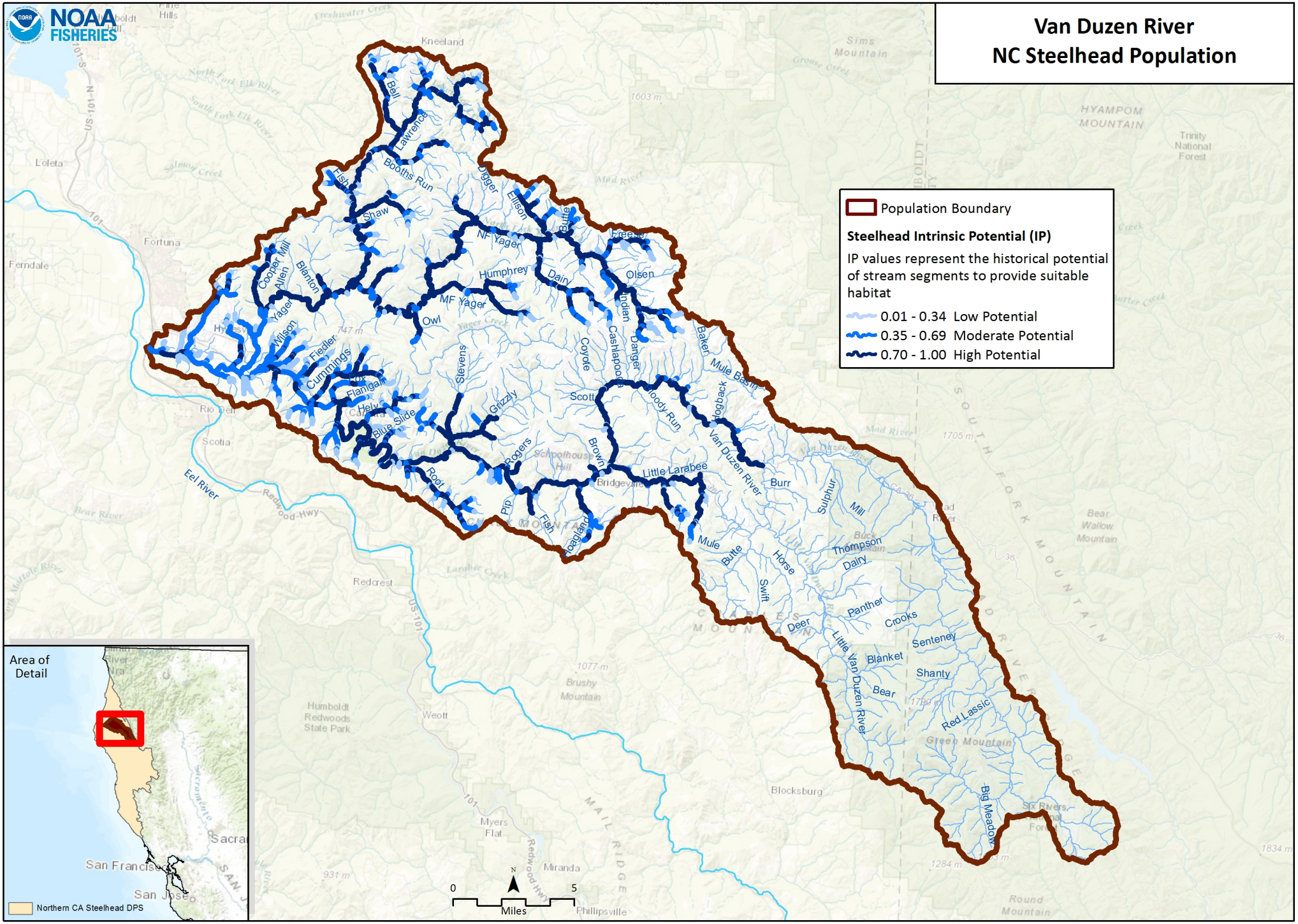
Van Duzen River
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Northern CA Steelhead DPS
Bell
Lawrence
Booths Run
Fish
Shaw
Digger
Ellison
Butte
Freeman
NF Yager
Humphrey
Dairy
Olsen
Indian
Danger
Baker
Mule Basin
Hogback
Cooper Mill
Allen
Blanton
Yager
Wilson
Fiedler
Cummings
Flanigan
Helm
Blue Slide
Owl
MF Yager
Stevens
Grizzly
Coyote
Cashlapooda
Scott
Woody Run
Brown
Rogers
Root
Pip
Fish
Hoagland
Bridgeville
Little Larabee
Van Duzen River
Burr
Sulphur
Mill
Mule
Butte
Horse
Swift
Thompson
Dairy
Deer
Panther
Crooks
Little Van Duzen River
Senteney
Blanket
Shanty
Bear
Red Lassic
Big Meadow
Loleta
Fortuna
Ferndale
Rio Dell
Scotia
Eel River
Redcrest
Weott
Humboldt Redwoods State Park
Myers Flat
Miranda
Phillipsville
Blocksburg
Hyampom Mountain
Trinity National Forest
Sims Mountain
Kneeland
Brushy Mountain
Green Mountain
Round Mountain
Bear Wallow Mountain
Six Rivers National Forest
Schoolhouse Hill
Mad River
Yager Creek
Larabee Creek
Bear River
Redwood Hwy
US-101
Freshwater Creek
North Fork Elk River
South Fork Elk River
Salmon Creek
Grouse Creek
Butter Creek
Muttole River
Sacramento
San Francisco
San Jose
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)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
		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	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 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-129	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	50% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	<50% of streams/ IP-Km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.36	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	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
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >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	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-130	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good

			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <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 to 74% 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	<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	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	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% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km	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	0.22-0.37	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-Km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-131	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
		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/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	Fair
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	60-80	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	12.1-17.9	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2012) :	Fair

									317/0.01 = 31,700	
			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	10-19% of Watershed in Agriculture	Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	>35% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	>75% Intact Historical Species Composition:	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	>3 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	>1 Miles/Square Mile	Poor
7	Summer Adults	Condition	Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% staging pool frequency)	50% to 74% of streams/ IP-Km (>20% staging pool frequency)	75% to 89% of streams/ IP-Km (>20% staging pool frequency)	>90% of streams/ IP-Km (>20% staging pool frequency)	<50% of streams/ IP-Km (>20% staging pool frequency)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor

			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	Poor
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-Km or <16 IP-Km accessible*	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-132	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Mainstem Temperature (MWMT)	<50% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	75 to 89% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	>90% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	50 to 74% mainstem IP km (<20 C MWMT; <18.1 C MWMT where coho IP overlaps)	Fair

			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
		Size	Viability	Abundance					<1 Spawner per IP-km, 317 IP km so <317 (317 IP km per Spence 2012)	Fair

Van Duzen River CAP Threat Results

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

Van Duzen River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
VaDR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VaDR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
VaDR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Develop plan to recreate off-channel ponds, alcoves, and backwater habitat.	2	5	NGO	115.00					115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
VaDR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Recreate habitat guided by plan.	3	5	NGO						TBD	Cost based on amount of habitat needed to be restored. Cost for floodplain restoration projects estimated at $37,200/acre.
VaDR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VaDR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
VaDR-NCSW-5.1.1.1	Action Step	Passage	Evaluate annually if plan addressing the sediment barrier at mouth of Van Duzen River is working effectively and modify if needed.	2	10	NGO	57.50	57.50				115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project. Additional cost expected for implementation of the plan once finalized.
VaDR-NCSW-5.1.1.2	Action Step	Passage	Develop and implement plan to address sediment barrier at mouth of Hely Creek,	3	10	NGO	57.50	57.50				115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project. Additional cost expected once plan is finalized.
VaDR-NCSW-5.1.1.3	Action Step	Passage	Develop and implement plan to address sediment barrier at mouth of Root Creek.	2	10	NGO	57.50	57.50				115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
VaDR-NCSW-5.1.1.4	Action Step	Passage	Develop and implement plan to address barrier at Wolverton Gulch.	2	10	NGO	21.50	21.50				43	Cost based on treating unknown partial barrier at a rate of $42,616/project.
VaDR-NCSW-5.1.1.5	Action Step	Passage	Develop and implement plan to address barrier at confluence of Van Duzen River with Cummings Creek.	3	10	NGO	21.50	21.50				43	Cost based on improving passage at unknown partial barrier at a rate of $42,616/project.
VaDR-NCSW-5.1.1.6	Action Step	Passage	Develop and implement plan to address barrier at confluence of Van Duzen River with Fiedler Creek.	2	10	NGO	21.50	21.50				43	Cost based on improving passage at unknown partial barrier at a rate of $42,616/project.
VaDR-NCSW-5.1.1.7	Action Step	Passage	Develop and implement plan to address culvert on Highway 36.	2	10	CalTrans	266.50	266.50				533	Cost based on improving passage at unknown partial barrier at a rate of $532,706/project.
VaDR-NCSW-5.1.1.8	Action Step	Passage	Develop and implement plan to address culvert on Rohnerville Road.	2	10	County	266.50	266.50				533	Cost based on improving passage at unknown partial barrier at a rate of $532,706/project.
VaDR-NCSW-5.1.1.9	Action Step	Passage	Restore passage to all life stages.	2	50	NGO	0						Cost accounted for in above action step.
VaDR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VaDR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.										
VaDR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop plan to add large wood, boulders, or other instream structure to specific areas in specific quantities.	2	5	NGO	115.00					115	Cost based on fish/habitat monitoring at a rate of $114,861/project. This action step should be coordinated with above action step, which can reduce redundancy and cost.
VaDR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Add structure, guided by plan.	2	5	NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.
VaDR-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										

Van Duzen River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
VaDR-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
VaDR-NCSW-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFW will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	5	CDFW, NMFS						0	Action is considered In-Kind
VaDR-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
VaDR-NCSW-16.2	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**										
VaDR-NCSW-16.2.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria										
VaDR-NCSW-16.2.1.1	Action Step	Fishing/Collecting	Work with CDFW to restrict or close the fisheries when flows are low to better protect steelhead.	3	5	CDFW						0	Action is considered In-Kind
VaDR-NCSW-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VaDR-NCSW-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										
VaDR-NCSW-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from areas.	2	5	NGO	173.00					173	Cost based erosion assessment of 5% of total acres at a rate of $12.62/acre.
VaDR-NCSW-18.1.1.2	Action Step	Livestock	Work with private landowners to install fence, guided by plan.	3	5	RCD, Private Landowners						TBD	Cost based on amount of riparian area fencing needed. Cost for exclusion fencing estimated at $3.62/ft.
VaDR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
VaDR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
VaDR-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	5	NGO	74.00					74	Cost based on riparian restoration monitoring at a rate of $73,793/project.
VaDR-NCSW-19.1.1.2	Action Step	Logging	Manage forests in identified areas to increase shade, guided by plan.	3	5	Private						0	Action is considered In-Kind
VaDR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**										
VaDR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
VaDR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	3	5	NGO						TBD	Cost based on miles of road network. Cost for road inventory is estimated at $957/mile.
VaDR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	5	NGO						TBD	Cost based on amount of road network needing to be decommissioned. Cost to decommission roads estimated at $12,000/mile.
VaDR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	3	5	NGO						TBD	Cost based on amount of road network needing to be upgraded. Cost to upgrade estimated at $21,000/mile.
VaDR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	50	RCD, Private Landowners						0	Action is considered In-Kind

Van Duzen River, Northern California Steelhead (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
VaDR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Develop and implement a plan to stabilize hillslope at Hely Creek 1,440 feet above Highway 36.	2	2	NGO						TBD	Cost based on size of unstable hillslope. Cost for erosion assessment estimated at $12.62/acre.
VaDR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Assess and prioritize bank stabilization needs and stabilize banks at Grizzly Creek.	3	4	RCD, Private Landowners						TBD	Cost based on size of unstable hillslope. Cost for erosion assessment estimated at $12.62/acre.
VaDR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Assess and prioritize bank stabilization needs and stabilize banks at Cummings Creek.	3	4	NGO						TBD	Cost based on size of unstable hillslope. Cost for erosion assessment estimated at $12.62/acre.
VaDR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
VaDR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
VaDR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	3	100	County						0	Action is considered In-Kind
VaDR-NCSW-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VaDR-NCSW-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
VaDR-NCSW-25.1.1.1	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer.	2	5	NGO						TBD	Cost based on amount of incentives to provide to reduce diversions during the summer. Some incentive programs are currently in place and this recommendation should coordinate with those efforts.
VaDR-NCSW-25.1.1.2	Action Step	Water Diversion /Impoundment	Document reduction in diversions and effects on salmonid habitat.	3	5	NGO	65.00					65	Cost based on stream flow/precipitation monitoring at a rate of $65,084/project.
VaDR-NCSW-25.1.1.3	Action Step	Water Diversion /Impoundment	Implement forbearance program.	3	5	NGO						0	Action is considered In-Kind
VaDR-NCSW-25.1.1.4	Action Step	Water Diversion /Impoundment	Create water budgets to avoid over-allocating water diversions.	3	5	RWQCB	65.00					65	Cost based on stream flow/precipitation monitoring at a rate of $65,084/project. This recommendation could be coordinated with above action steps.
VaDR-NCSW-25.1.1.5	Action Step	Water Diversion /Impoundment	Utilize water budgets when allocating diversions.	3	5	RWQCB						0	Action is considered In-Kind
VaDR-NCSW-25.1.1.6	Action Step	Water Diversion /Impoundment	Conduct a study to document extent of water diversions and the effects these diversions have on salmonids, which includes recommendations for amount of diversions that would not limit recovery of salmonids.	3	5	RWQCB						0	Cost accounted for in above action step.
VaDR-NCSW-25.1.1.7	Action Step	Water Diversion /Impoundment	Reduce diversions to level that would not limit recovery of salmonids.	3	30	RWQCB						TBD	Cost based on amount of diversions and stream flow levels needed for salmonids. The magnitude of diversion numbers, rates, and timing should be identified in above action step.
VaDR-NCSW-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
VaDR-NCSW-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
VaDR-NCSW-25.2.1.1	Action Step	Water Diversion /Impoundment	Revise County General Plan as needed to account for salmonid habitat needs.	3	5	County						0	Action is considered In-Kind
VaDR-NCSW-25.2.1.2	Action Step	Water Diversion /Impoundment	Revise City ordinances as needed to account for salmonid habitat needs.	3	5	City						0	Action is considered In-Kind