Interior Diversity Stratum

This stratum includes populations of steelhead that spawn in interior watersheds that do not exhibit characteristics typical of coastal watersheds. These watersheds are typically warmer and drier in the summer due to the lack of coastal fog, and exhibit substantially different vegetation (e.g., oak savannahs and cottonwood riparian corridors, as opposed to redwood/conifer forests).

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

- Dry Creek
- Maacama Creek
- Mark West Creek
- Upper Russian River
- Interior Diversity Stratum Rapid Assessment
    - Crocker Creek
    - Gill Creek
    - Miller Creek (Russian)
    - Sausal Creek

CCC steelhead Interior Diversity Stratum Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting.

Diversity Stratum	CCC Steelhead Population	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Interior	Crocker Creek	D	Supporting	4.5	6-12	25-52
	Dry Creek	I	Essential	116.7	26.0	3,000
	Gill Creek	D	Supporting	7.2	6-12	41-84
	Maacama Creek	I	Essential	76.2	31.6	2,400
	Mark West Creek	I	Essential	164.2	20	3,300
	Miller Creek (Russian)	D	Supporting	3.1	6-12	17-35
	Sausal Creek	D	Supporting	11.1	6-12	65-131
	Upper Russian River	I	Essential	423.9	20	8,500
	Interior Diversity Stratum Recovery Target					**17,200**

CCC steelhead Interior Diversity Stratum

Dry Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: Interior
- Spawner Abundance Target: 3,000 adults
- Current Intrinsic Potential: 116.7 IP-km

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

Abundance and Distribution

Although rigorous juvenile or adult sampling were not historically conducted within the Dry Creek watershed, periodic surveys by the California Department of Fish and Wildlife (CDFW) from the 1950s and 1960s suggest high steelhead productivity within the various tributary sub-watersheds prior to the construction of Lake Sonoma in 1980. Sporadic sampling (both spatially and temporally) occurred historically within the tributaries, and it appears the most consistent sampling efforts took place within largest tributaries such as Mill and Pena Creeks. The trends from these sampling efforts suggest steelhead abundance has declined over the past several decades within most tributary reaches. For example, CDFW noted that young-of-the-year steelhead were abundant throughout the sampling reach during a 1957 survey, and very large numbers of newly emerged juvenile steelhead during a May, 1964 survey in Pena Creek (CDFG 2006). For comparison, CDFW surveys in the 1980s and 1990s in Mill Creek documented juvenile low and moderate steelhead numbers respectively (CDFG 2006).

In 1980, the Don Clausen Fish Hatchery (DCFH) on Dry Creek was constructed by the U.S. Army Corps of Engineers (USACE) to compensate for lost spawning and nursery areas upstream of Warm Springs Dam—Lake Sonoma Project. Warm Springs Dam was not designed with fish passage facilities; thus, steelhead are precluded from accessing the approximately 130 square miles of watershed located upstream of the dam near the confluence with Pena Creek (CDFG 2004). Steelhead are widely distributed throughout the 14 miles of the Dry Creek mainstem, which is augmented to a large degree by hatchery production. The established mitigation goals included 300,000 released smolts and 6,000 returning adults to Dry Creek. In 1993, juvenile steelhead production peaked with the release of over 1.5 million juveniles from the DCFH (CDFG 2011a). Between 1982 and 2012 adult steelhead returns ranged from 333 to 8,100, with the peak in 1995 (CDFG 2011b).

The Sonoma County Water Agency (SCWA) has been trapping out-migrating smolts on Dry Creek since 2009 in response to monitoring required through the NMFS Russian River Biological Opinion (NMFS 2008). Wild downstream migrant abundance estimates (including young-of-year (YOY) and parr) migrating down Dry Creek ranged from 71,000 (2009) to 42,000 (2010) to 32,000 (2011) with the makeup of YOY to parr ranging from 20 to 50% (Manning and Martini-Lamb 2012). While the proportion of wild and hatchery steelhead in the adult steelhead population in Dry Creek has not been well documented, in 2010 and 2011 SCWA was able to operate the counting video/counting station at Mirabel long enough to get a representative sample; in 2010 and 2011, of 530 and 600 fish counted, the proportion of hatchery to wild was 3:1 and 4:1 respectively (S. Chase, Sonoma County Water Agency, personal communication, 2013).

History of Land Use

Land use within the Dry Creek basin has been dominated by agriculture since the late 1800s. At the turn of the 19th century, the Dry Creek valley was one of California's premier producers of Zinfandel grapes. Following prohibition in the early 1920s, much of the vineyard acreage was replaced by fruit trees, with most of the fruit processed in nearby Healdsburg. Following the repeal of prohibition, the valley again shifted to primarily grape production. Since the 1970s, the conversion of forest land to vineyards has accelerated dramatically, where today over one fourth of the watershed area below Warm Springs Dam is in grape production. Urban development has been limited within the watershed; the city of Healdsburg, located within the extreme southeast corner of the watershed, is the only urbanized area of significance. Limited cattle grazing and logging occur within some tributaries.

Current Resources and Land Management

Completed in 1982, Warm Springs Dam, located upstream of the Pena Creek confluence, forms Lake Sonoma, a multi-purpose reservoir providing flood protection, municipal water storage, and hydroelectric power. A fish hatchery operates at the base of the dam, producing steelhead and coho salmon to mitigate lost habitat in the upper watershed. The USACE owns the dam and appurtenant structures, as well as a significant area of land surrounding Lake Sonoma, and controls the winter flow releases to avoid flooding of the lower river. Summer flow releases are managed by SCWA in accordance with its state water right permit, which maintains around 100-200 CFS nearly year round to meet the water supply needs of over 600,000 customers over 9 cities/districts within Sonoma and Marin Counties. SCWA actively monitors salmonid populations within Dry Creek, the mainstem Russian River, to evaluate and monitor their operations in the Russian River basin to comply with a 2008 biological opinion governing those operations. To mitigate high flow releases, SCWA has removed passage barriers to several

tributaries, and will complete 6 miles of habitat enhancement between the years 2013 and 2020, to improve velocity refugia on Dry Creek by enlisting the cooperation between local, state, and Federal agencies and local land-owners/vintners.

Salmonid Viability and Watershed Conditions

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

Current Conditions

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

Hydrology: Baseflow & Passage Flows

Hydrology within the Dry Creek basin has been severely altered from the historical flow regime of less than 1 cfs during the dry months. The storm driven winter natural hydrology (e.g., up to 30,000 cfs) in the reach below Warm Springs Dam has been severely truncated to no more than 6,000 cfs, while the natural low flow summer flows (e.g., 1-5 cfs) have been elevated to a steady, year-round baseflow of approximately 100-200 cfs (Steiner 1996). The altered flow regime has simplified mainstem aquatic and riparian habitat within the lowermost 14 miles of Dry Creek (Inter-fluv Inc. 2010), and the high summer flows are likely limiting rearing juvenile salmonids (Entrix Inc. 2003). Within many Dry Creek tributaries, agricultural operations have diminished both summer and spring flow levels by diverting/pumping stream flows for irrigation and frost control (NMFS 2009). Domestic well pumping also likely impacts summer baseflows within tributaries of the basin.

Habitat Complexity: Large Wood & Shelter

Inadequate instream shelter predominantly affects juvenile steelhead, which depend on complex instream and edgewater habitat features to provide cover from predators (Shirvell 1990) and low-velocity refuge from high winter flow events (Bustard and Narver 1975). Submerged LWD often comprises a large component of available shelter within streams located in forested landscapes (Shirvell 1990), such as Dry Creek. Shelter ratings throughout much of the Dry Creek basin are Poor, with 29 of 31 sampled stream reaches having a shelter score below 80 (SEC data). Similarly,

LWD volume was also low throughout most sampled tributary reaches, as evidenced by the high frequency with which CDFW personnel suggested LWD restoration as a critical priority within their Dry Creek watershed stream reports. Interfluve (2010) shows higher shelter rating values (>80 for nine out of 15 reaches) for mainstem Dry Creek.

Estuary: Quality & Extent

Past management activities within the Russian River estuary have likely degraded parr and smolt steelhead rearing habitat. Since 2009, SCWA has partnered with NMFS and CDFW to adaptively manage the estuary as a "perched" or closed freshwater lagoon while minimizing flood risk within the lower river. To address flooding concerns within the lower estuary, SCWA breaches the estuary sand bar once the water surface elevation reaches a critical height. The elevated Dry Creek flows present a challenge to managing water levels in the lagoon, requiring a balance between flooding adjacent low lying properties in Jenner and to providing highly productive summer rearing habitat for juvenile salmonids, including steelhead. Please see the Russian River Overview for more information.

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

Adult steelhead utilize pool habitat as holding habitat during upstream migration, while deeper pools are preferred habitat of larger, 1- and 2-year old juvenile steelhead (Everest and Chapman 1972). Wood plays a key role in creating and maintaining pool habitat within stream systems (Montgomery *et al.* 1995; Rosenfeld and Huato 2003), yet quality pool habitat is lacking throughout most tributary and mainstem reaches of Dry Creek, likely due in large part to lack of LWD.

Passage/ Migration: Mouth of Confluence & Physical Barriers

Barriers and impediments alter or entirely preclude migration and seasonal movement patterns of both adult and juvenile steelhead. Warm Springs Dam blocks salmon and steelhead access to up to 105 miles of historical habitat located within the upper Dry Creek basin (SEC 1996). Smaller barriers/impediments exist on Mill and Grape Creeks. Dutcher Creek is currently mostly inaccessible to salmonids due to the presence of numerous artificial barriers just upstream of the mouth.

Other Current Conditions

The connection between floodplain habitat and lower tributary stream channels throughout the broad Dry Creek Valley is limited where the creek is adjacent to agricultural areas due to the encroachment of vegetation on the Dry Creek mainstem. Warm Springs Dam alters the natural transportation of gravel and wood from the upper half of the watershed, but does not appear to be a significant cause of the extensive channel instability witnessed within Dry Creek during the

past several decades (Inter-fluv Inc. 2010). Instead, intensive gravel mining and several large flood and fire events can be attributed to the vertical incision and lateral erosion within the mainstem as both processes were already well established prior to dam completion. Recently, channel condition appears to be improving, as the rate of incision has slowed and much of the mainstem channel has approached a point of equilibrium with regard to incision/aggradation (Inter-fluv Inc. 2010). However, riparian composition and function in Dry Creek has been adversely impacted by the dam, with the less frequent scouring flows emanating from the dam allowing a dense riparian corridor of 20 and 30-year old trees to establish. The dense growth has confined the Dry Creek channel, precluded lateral channel migration, and sequestered large volumes of coarse bed material outside of the active channel (Inter-fluv Inc. 2010).

Threats

The following discussion focuses on those threats that rate as High or Very High (See Dry Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts.

Agriculture

Agricultural operations (predominantly grape growing) occur throughout the low lying elevations, and vineyards are also common in the higher elevations of the Dry Creek watershed. Where agricultural land has encroached upon tributary riparian zones, the corridor is thin; wood recruitment and shade are at low levels; and sediments and chemicals can readily enter the stream channel during runoff periods. Water diversions and near-stream groundwater pumping for irrigation are likely a primary cause of chronic low-water conditions in tributaries commonly observed during summer (Deitch *et al*. 2008; NMFS 2009).

Channel Modification

Where riprap and other hardened stabilization techniques have been employed to prevent erosion and loss of land, stream velocity is high, and shelter for juvenile fish or resting adults is low. Additionally, hardened bank stabilization, such as riprap and wooden crib-walls, can preclude the natural hydrologic and floodplain function necessary for creating and maintaining instream habitat (FEMA 2009). In the 1980s, the USACE installed various structures along mainstem Dry Creek, including car bodies, creosote crib walls, submarine netting, steel "jacks" and concrete weirs with fish ladders to stem downcutting and lateral erosion. Many of these structures have been deemed ineffective and are currently being considered for removal or modification as part of the enhancement of Dry Creek required by the biological opinion.

Habitat Complexity

The Dry Creek CAP analysis rated shelter condition as Poor for summer rearing juveniles throughout much of the watershed; conditions that were likely a direct result of documented poor LWD volume. Habitat complexity created by submerged LWD likely comprised a large component of available shelter within tributary streams located in forested landscapes. As part of their stream habitat inventory program, CDFW recommended pool habitat restoration within most of the tributaries to Dry Creek. Some of these recommendations have been fulfilled through the enhancement of work by SCWA (e.g., Grape, Wine and Crane Creeks) and DFW (e.g., Mill Creek).

Roads and Railroads

Embeddedness levels are high due to sediment from problem public and private roads and active erosion sites throughout the upper portions of tributary subwatershed, such as Pena and Mill Creeks, which have both been the subject of programmatic sediment surveys. Remaining subwatersheds should be assessed and treatments developed to upgrade and decommission problem roads to reduce surface runoff and high stream velocities.

Water Diversions and Impoundments

Water diversions supporting agriculture within Dry Creek are likely a primary cause of the low flow conditions impacting fish during the spring and summer months (Deitch *et al.* 2008). Furthermore, water diversions and impoundments can also impact fish directly. Many diversions are unpermitted and do not address fish passage or screening considerations. The largest impoundment in the system, Warm Springs Dam, blocks fish passage into over half the Dry Creek watershed, and interrupts the downstream transport of wood and sediment from the upper basin.

Other Threats

Within the Russian River, hatchery steelhead are genetically identical to wild fish, and thus both are listed as part of the CCC steelhead ESU. In 2004, mitigation and enhancement goals for the hatchery were modified to 300,000 juveniles and 6,000 adults to better reflect a balance of hatchery and wild fish in the basin, and wild fish are now introgressed into hatchery breeding to aid genetic diversity (B. Wilson, CDFW, personal communication, 2011). Though hatchery steelhead smolts may compete with wild juvenile steelhead, hatchery smolts tend to out-migrate quickly and therefore any competition is likely fleeting (NMFS 2008). Competition among adults for spawning habitat may occur, but is thought to be largely restricted to the mainstem channel (NMFS 2008).

Limiting Conditions, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer and winter rearing habitat are most limiting steelhead production within the Dry Creek basin. Poor juvenile rearing habitat was documented within the mainstem channel, due largely to high summer releases from WSD interacting with impaired riparian and stream channel function. Within Dry Creek tributaries, juvenile habitat is limited by poor LWD volume and a general lack of instream cover. During summer months, low flow volume can also limit the availability of juvenile habitat in tributary reaches.

General Recovery Strategy

Continue Planned Enhancement Within Mainstem and Tributary Reaches

The Dry Creek watershed is currently undergoing an ambitious enhancement plan brought about through the Russian River Biological Opinion (NMFS 2008). As part of the implemented Reasonable and Prudent Alternative, SCWA and the Corps will be funding a multi-million dollar project aimed at improving six miles of mainstem channel to near-optimum coho and steelhead habitat. Also, five separate projects aimed at improving instream habitat and fish passage will occur within four important Dry Creek tributaries. Ensuring future implementation of these restoration actions is critically important.

Address Impaired Tributary Hydrology

Low tributary flows likely impair juvenile steelhead survival during both spring and summer, although the mechanism by which these flow effects manifest is different for each season and stream. In spring, acute stream flow pumping in response to frost events can cause rapid dewatering of the stream channel. Conversely, summer low flows are more of a chronic, long-term effect brought about largely by steady agricultural and residential stream diversions and well pumping. Restoration actions should foster coordination between landowners during low flow conditions to minimize acute dewatering episodes, and encourage the use of alternative frost protection strategies (e.g., wind fans, off-channel reservoirs, etc.), many of which have already been successfully employed throughout the watershed.

Improve Instream Habitat Quality and Quantity

Although the planned restoration actions brought about by the Russian River Biological Opinion will improve LWD volume and shelter availability within the mainstem Dry Creek and select tributaries, further restoration actions will be needed to address these issues within many of the remaining tributaries where poor LWD and shelter conditions likely limit habitat carrying capacity and function.

Identify, Prevent and Reduce Sediment Sources

Treatments proposed from existing road sediment surveys should be prioritized and restoration actions implemented by Sonoma County Department of Transportation and private landowners. Additionally, remaining roads (mostly private) should be addressed as part of a comprehensive sediment reduction and transportation plan for the entire basin. Future road construction should utilize Best Management Practices (BMPs) to prevent altering watershed hydrologic processes, sediment transport and fish passage, and construction of roads within riparian zones should be avoided or minimized. BMPs to prevent sediment into the stream environment, from agriculture, road building and maintenance, and cattle grazing within riparian areas should be implemented.

Evaluate and Improve the Regulated Flow Structure

Current efforts between NMFS and the NWS California/Nevada River Forecasting Center, Monterey Weather Forecasting Office and the Office of Hydrologic Development, SCWA and the USACE seek to balance and sustain fisheries flows while maximizing reservoir capture of watershed runoff. These efforts involving forecast-based reservoir operations for flood control and conservation, modeling watershed runoff and improvement of atmospheric rainfall and river forecasts to identify opportunistic periods for diversion and bypass should be supported. Based on this evaluation and information, NMFS will work with the USACE to modify the "rule curve" associated with storage and releases from Lake Sonoma in the interest of fisheries flows.

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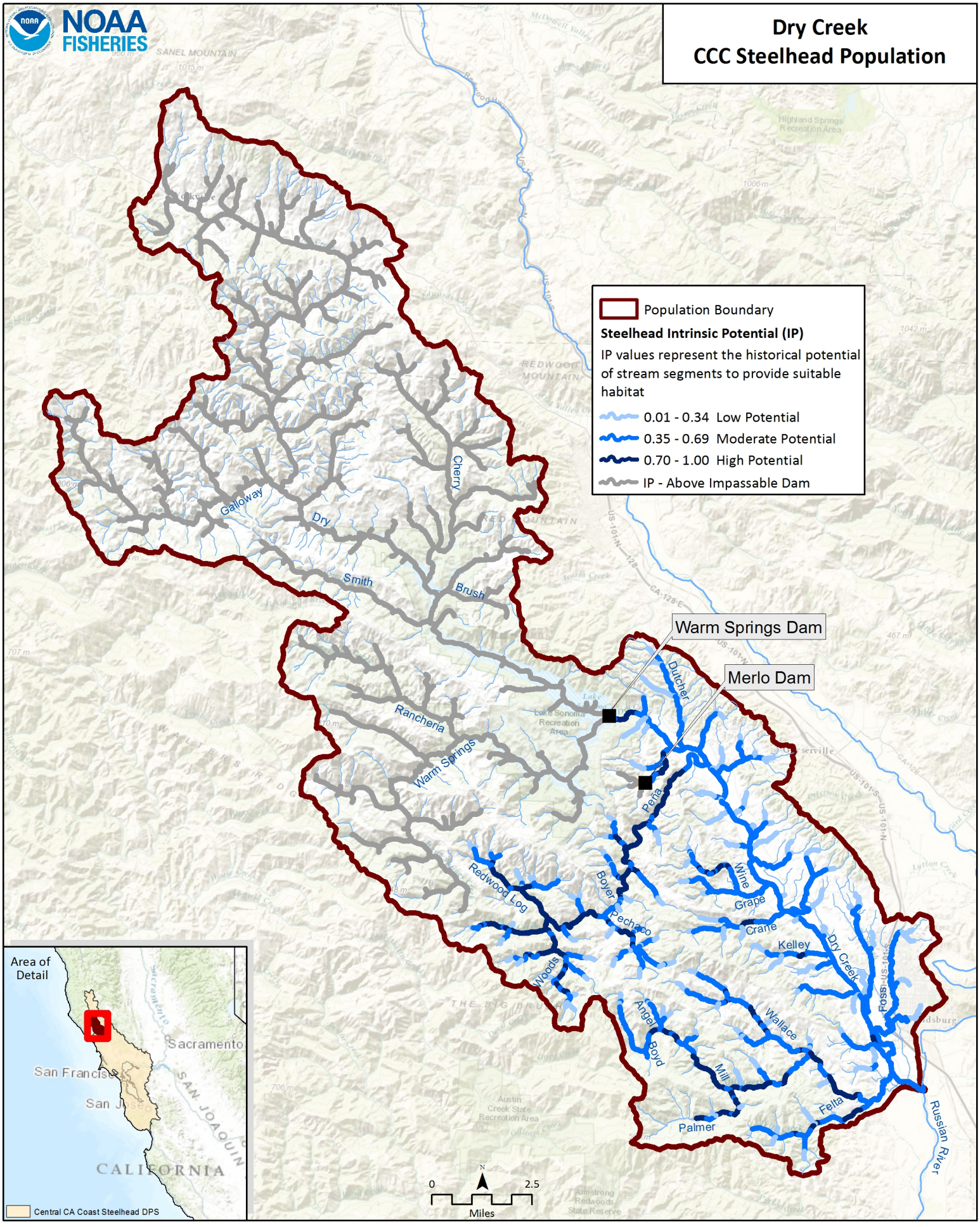
NOAA FISHERIES
Dry Creek
CCC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
Warm Springs Dam
Merlo Dam
Galloway
Dry
Cherry
Smith
Brush
Rancheria
Warm Springs
Dutcher
Pena
Redwood Log
Boyer
Pechaco
Wine
Grape
Crane
Kelley
Dry Creek
Foss
Woods
Angel
Boyd
Wallace
Mill
Felta
Palmer
Russian River
Area of Detail
Sacramento
San Francisco
San Jose
SAN JOAQUIN
CALIFORNIA
Central CA Coast Steelhead DPS
0
2.5
Miles
N

CCC Steelhead Dry Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	55% of streams/ 55% of 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)	1% of IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58.3	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	91.1% 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	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	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawner per IP-km to < low risk spawner density per Spence (2008)	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		>1 spawner per IP-km to < low risk spawner density per Spence (2008)	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 75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ 25% of IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	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% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	29% of streams/40% of IP-km (>40% average primary pool frequency)	Poor
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	55% of streams/ 55% of 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)	1% of 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	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 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	2.76 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	91.1% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	70% of streams/ 67% of IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	24% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ 25% of IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	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	0.26 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	44% 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% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	55% of streams/ 55% of 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)	1% of IP-km (>80 stream average)	Poor
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	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)	43% of streams/ 25% of IP-km (>50% stream average scores of 1 & 2)	Poor
Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition		Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	1% of 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	2.76 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 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	>90% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.619% 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	>30% of Watershed in Agriculture	Poor
			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	5% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.9 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.0 Miles/Square Mile	Poor

CCC Steelhead Dry Creek CAP Threat Results

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

Dry Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DC-CCCS-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
DC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Improve over-winter survival by increasing the frequency and functionality of floodplain habitats.	2	10	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, Sonoma County, USACE	
DC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, removal of levees, and use setback levees where appropriate.	2	25	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, Sonoma County, USACE	
DC-CCCS-2.1.1.3	Action Step	Floodplain Connectivity	Implement actions that re-establish the hydrologic connection between stream channels and adjacent floodplain habitat.	2	50	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, Sonoma County, USACE	
DC-CCCS-3.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
DC-CCCS-3.1.1	Recovery Action	Hydrology	Prevent or minimize impairment to stream hydrology (impaired water flow)				
DC-CCCS-3.1.1.1	Action Step	Hydrology	Support efforts to provide improved localized weather prediction capabilities in support of finer scale frost protection capabilities for the benefit of grape growers and fisheries flows.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD, Water Agencies	
DC-CCCS-3.1.1.2	Action Step	Hydrology	Avoid and/or minimize the adverse effects of water diversion on salmonid habitat by establishing a more natural hydrograph, by-passing adequate downstream flows, regulating season of diversion, and promoting and implementing off-stream storage solutions (CDFG 2004).	1	25	CDFW, NMFS, Sonoma County, SWRCB	
DC-CCCS-3.1.1.3	Action Step	Hydrology	Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	5	CDFW, NMFS, SWRCB	
DC-CCCS-3.1.1.4	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of Chinook salmon/steelhead and authorized diverters (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
DC-CCCS-3.1.1.5	Action Step	Hydrology	Support the development and implementation of groundwater use regulations.	3	10	CDFW, NMFS, SWRCB	
DC-CCCS-3.1.1.6	Action Step	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	100	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
DC-CCCS-3.1.1.7	Action Step	Hydrology	Evaluate requests for on-stream dams above migratory reaches for effects on the natural hydrograph and spawning gravel recruitment downstream (CDFG 2004).	3	100	CDFW, NMFS, SWRCB	
DC-CCCS-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
DC-CCCS-5.1.1.1	Action Step	Passage	Improve fish passage at sites identified as partial or total barrier to anadromy. High priority tributary watersheds include Mill, Pena and Grape Creek.	1	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-5.1.1.2	Action Step	Passage	Investigate passage barriers on Dutcher Creek, Felta Creek (CDFW survey reach 2), Foss Creek, Mill Creek, Norton Creek, Pine Ridge Canyon Creek, Schoolhouse Creek, West Slough, and Wine Creek (CDFW stream survey reports). Pena Creek tributaries should also be investigated.	1	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-5.1.1.3	Action Step	Passage	The falls on lower Mill Creek and on lower Felta Creek need to be evaluated for passage periodically. Adjustment may be needed presently on Mill Creek. (CDFG 2002).	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-5.1.1.4	Action Step	Passage	Log-jams in the Chapman Branch and Pena Creek need to be monitored/investigated for passage. Prior to removing logjams, consult with NMFS and CDFW fish passage specialists (CDFG 2002).	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				

Dry Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Where feasible, design and engineer pool enhancement structures to increase the number of pools. All tributary streams, aside from Grape, Mill, and Pine Ridge Canyon, are high priority streams.	2	25	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Complete stream habitat surveys within Dry Creek tributaries where potential habitat exists above the CDFW survey reach.	2	5	CDFW	
DC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Develop tributary pool and shelter projects with cooperative landowners to enhance presmolt and smolt survival	2	100	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Encourage bio-engineering projects to address erosion issues on private lands.	2	3	CDFW, NOAA RC, NRCS, RCD	
DC-CCCS-6.1.1.6	Action Step	Habitat Complexity	Finish implementation of instream habitat restoration along six miles of mainstem Dry Creek as specified within the Russian River Biological Opinion (NMFS 2008).	2	10	CDFW, NMFS, Sonoma County Water Agency, USACE	
DC-CCCS-6.1.1.7	Action Step	Habitat Complexity	Encourage Dry Creek landowners to become Cooperators in the Dry Creek Valley Programmatic Safe Harbor Agreement.	2	5	NMFS, Private Landowners, Sonoma County Water Agency	
DC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools				
DC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Enhance Dry Creek mainstem and tributary migration and resting habitats with LWD, boulders, and other instream features to increase habitat complexity and improve staging pool frequency and depth	1	25	CDFW, NMFS, NOAA RC, NRCS, RCD	
DC-CCCS-6.1.3	Recovery Action	Habitat Complexity	Increase large wood frequency				
DC-CCCS-6.1.3.1	Action Step	Habitat Complexity	Improve instream LWD volumes throughout all Dry Creek tributary reaches, except for recently restored reaches in Grape Creek.	2	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-6.1.3.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features which provide stream complexity, pool frequency, and depth when evaluating permits for stream or bank modification.	3	100	CDFW, NOAA RC, Private Landowners	
DC-CCCS-6.1.3.3	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-6.1.3.4	Action Step	Habitat Complexity	Educate landowners regarding the importance of LWD to stream habitat creation and natural fluvial processes, and the need to leave LWD within the stream channel.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-7.1.1	Recovery Action	Riparian	Improve canopy cover				
DC-CCCS-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	20	CDFW, NMFS, NOAA RC, Private Landowners, RCD	
DC-CCCS-7.1.1.2	Action Step	Riparian	Fence riparian areas within the Dry Creek watershed from grazing by using fencing standards that excludes cattle but allows other wildlife to access the stream. High priority stream reaches include Pechaco Creek (reach 1 and 2) and Pena Creek (reach 3) (CDFW stream survey reports).	2	2	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-7.1.1.3	Action Step	Riparian	Increase canopy cover levels within the Dry Creek watershed. Priority streams include Fall Creek (reach 1), Felta Creek (reach 2,3), Foss Creek, Mill Creek, Norton Creek, Pechaco Creek (reach 1,2,3), Pena Creek, West Slough, Wine Creek (reach 1), and Woods Creek (reach 1,2,3) (CDFW stream survey reports).	2	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-7.1.1.4	Action Step	Riparian	Encourage the restoration of floodplain function and protect riparian vegetation to improve migration and summer/overwintering habitat for steelhead and Chinook salmon.	2	100	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-7.1.1.5	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, ivy, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	3	20	CDFW, NMFS, NOAA RC	
DC-CCCS-7.1.2	Recovery Action	Riparian	Improve tree diameter				

Dry Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DC-CCCS-7.1.2.1	Action Step	Riparian	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	100	Land Trusts, Private Landowners	
DC-CCCS-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CDFW, NOAA RC, Private Landowners	
DC-CCCS-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
DC-CCCS-8.1.1.1	Action Step	Sediment	Initiate road assessments and landslide mapping in the Dry Creek watershed. High priority streams include Crane Creek, Felta Creek (reach 3,4), Grape Creek, Mill Creek, Palmer Creek, Pena Creek, Pine Ridge Canyon Creek, Wallace Creek, Wine Creek and Woods Creek (CDFW stream survey reports).	2	20	CDFW, NMFS, NOAA RC, NRCS, RCD, Sonoma County	
DC-CCCS-8.1.1.2	Action Step	Sediment	Implement completed road assessments to address sediment-related and runoff-related problems and correct problems with road hydrologic connectivity to streams.	2	20	CDFW, NOAA RC, NRCS, Private Landowners, Public Works, RCD	
DC-CCCS-8.1.1.3	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC steelhead and CC Chinook salmon recovery priorities.	3	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-8.1.1.4	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW, or CalFire.	2	50	CDFW, NMFS	
DC-CCCS-8.1.1.5	Action Step	Sediment	Debris jams are potentially trapping sediment and eroding adjacent banks within Schoolhouse Creek, Wine Creek, and Woods Creek. The jams should be analyzed for possible removal or modification (CDFW stream survey reports).	2	5	CDFW, NMFS, NOAA RC	
DC-CCCS-8.1.1.6	Action Step	Sediment	Spawning gravel is limited within Dutcher Creek (reach 1), Fall Creek, Felta Creek, Grape Creek, and Wine Creek (upper and lower reaches) (CDFW stream habitat reports). Implement actions to improve spawning gravel abundance and quality within these stream.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria				
DC-CCCS-11.1.1.1	Action Step	Viability	Monitor population status for response to recovery actions.	2	10	CDFW, NOAA RC, Private Landowners, RCD	
DC-CCCS-11.1.1.2	Action Step	Viability	Utilize CDFW approved implementation, effectiveness, and validation monitoring protocols when assessing efficacy of restoration efforts.	3	100	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-11.1.1.3	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	3	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-11.1.1.4	Action Step	Viability	Conduct a comprehensive assessment of watershed processes (e.g., hydrology, geology, fluvial-geomorphology, water quality, and vegetation), instream habitat, and factors limiting steelhead and Chinook salmon production.	3	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-11.1.1.5	Action Step	Viability	Evaluate feasibility of installing a lifecycle station in an appropriate location within the watershed. Implement action if found feasible.	1	10	CDFW, NMFS, Sonoma County Water Agency	
DC-CCCS-11.1.1.6	Action Step	Viability	Improve smolt condition factor through the addition of Salmon Analog pellets until adult population returns reach nutrient sustaining levels.	1	10	, CDFW, NMFS, Russian River Wild Steelhead Society, USACE	
DC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
DC-CCCS-12.1.1.1	Action Step	Agriculture	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with CCC steelhead and CC Chinook salmon recovery priorities.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	

Dry Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DC-CCCS-12.1.1.2	Action Step	Agriculture	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	10	CDFW, Farm Bureau, NMFS, Private Landowners, RCD	
DC-CCCS-12.1.1.3	Action Step	Agriculture	Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.	3	25	CDFW, NMFS	
DC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.				
DC-CCCS-12.1.2.1	Action Step	Agriculture	Minimize future sediment and runoff sources from agricultural land by modifying actions that deliver sediment and runoff to stream channels. Assess the effectiveness of erosion control measures throughout the winter period.	3	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-12.1.2.2	Action Step	Agriculture	Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to address sediment source reduction, riparian habitat, forest health, and restoration.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-12.1.2.3	Action Step	Agriculture	Encourage the NRCS, RCDs, and other appropriate organizations to increase the number of landowners participating in sediment reduction planning and implementation.	3	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
DC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
DC-CCCS-12.2.1.1	Action Step	Agriculture	Promote agricultural practices that protect and restore steelhead and Chinook salmon habitat by working with the agricultural community.	3	10	CDFW, Counties, NMFS, NOAA SWFSC	
DC-CCCS-12.2.1.2	Action Step	Agriculture	Streamline permit processing where landowners are conducting actions aligned with recovery priorities.	3	5	CDFW, Counties, NMFS, NRCS, RCD, SWRCB, USACE	
DC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology				
DC-CCCS-13.1.1.1	Action Step	Channel Modification	All proposed levees should be designed to account for minimal maintenance associated with an intact and functioning riparian zone.	2	100	FEMA, NMFS, Private Landowners, Sonoma County	
DC-CCCS-13.1.1.2	Action Step	Channel Modification	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	2	30	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, RCD, Sonoma County, USACE	
DC-CCCS-13.1.1.3	Action Step	Channel Modification	Avoid or minimize the effects from flood control projects on salmonid habitat.	3	100	CDFW, FEMA, NMFS, Private Landowners, Sonoma County	
DC-CCCS-13.1.1.4	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	3	100	CDFW, NMFS, Private Landowners, Sonoma County	
DC-CCCS-13.1.1.5	Action Step	Channel Modification	Discourage stabilization projects which will lead to additional instability either up- or downstream.	3	100	CDFW, NMFS, Sonoma County, USACE	
DC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
DC-CCCS-13.1.2.1	Action Step	Channel Modification	Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow “emergencies”.	3	100	CDFW, NMFS, NRCS, Private Landowners, RCD, Sonoma County, USACE	
DC-CCCS-13.1.2.2	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	3	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
DC-CCCS-17.1	**Objective**	**Hatcheries**	**Address other natural or manmade factors affecting the species' continued existence**				
DC-CCCS-17.1.1	Recovery Action	Hatcheries	Prevent or minimize reduced density, abundance, and diversity				
DC-CCCS-17.1.1.1	Action Step	Hatcheries	Manage Russian River Hatcheries following a Hatchery Genetic Management Plan (HGMP) which is regularly updated to include adaptive management strategies and recommendations.	1	5	CDFW, NMFS, USACE	

Dry Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DC-CCCS-17.1.1.2	Action Step	Hatcheries	Evaluate the need for revising release numbers, release sizes, release locations and strategies in the context of meeting recovery goals and mitigation requirements of both Russian River Hatcheries (DCFH and CVFF). Update and revise the HGMP according to proposed changes and recommendations	1	5	CDFW, NMFS, USACE	
DC-CCCS-17.1.1.3	Action Step	Hatcheries	Preserve and manage the remaining genetic and phenotypic characteristics that promote life history variability in both hatchery and wild populations.	1	5	CDFW, NMFS, NOAA SWFSC, USACE	
DC-CCCS-17.1.1.4	Action Step	Hatcheries	Evaluate hatchery utilization in the context of increasing abundance and spatial distribution of steelhead in the Russian River and the larger CCC DPS.	1	5	CDFW, NMFS, USACE	
DC-CCCS-17.1.1.5	Action Step	Hatcheries	If stocking is reinitiated, implement changes identified in Hatchery Genetic Management Plans to improve genetic and rearing management	1	5	CDFW, NMFS, USACE	
DC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Improve instream gravel quality				
DC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Initiate road assessments and landslide mapping in the Dry Creek watershed. High priority streams include Crane Creek, Felta Creek (reach 3,4), Grape Creek, Mill Creek, Palmer Creek, Pena Creek, Pine Ridge Canyon Creek, Wallace Creek, Wine Creek and Woods Creek (CDFW stream survey reports).	2	20	CDFW, NMFS, NOAA RC, NRCS, RCD, Sonoma County	
DC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Implement completed road assessments to address sediment-related and runoff-related problems and correct problems with road hydrologic connectivity to streams.	2	25	CDFW, NOAA RC, NRCS, Private Landowners, Public Works, RCD	
DC-CCCS-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
DC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
DC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Implement changes to D1610 as specified within the Russian River Biological Opinion (NMFS 2008).	1	5	CDFW, SWRCB, USACE, Water Agencies	
DC-CCCS-25.1.1.2	Action Step	Water Diversion/ Impoundment	Support current efforts to balance and sustain fisheries flows while maximizing reservoir capture of watershed runoff. These efforts involving forecast-based reservoir operations for flood control and conservation, modeling watershed runoff, and improvement of atmospheric rainfall and river forecasts to identify opportunistic periods for diversion and bypass should be supported.	1	5	CDFW, NMFS, NOAA NWS, Private Landowners, Sonoma County Water Agency, SWRCB, USACE	
DC-CCCS-25.1.1.3	Action Step	Water Diversion/ Impoundment	Promote water conservation best practices such as drip irrigation for vineyards.	2	5	CDFW, Farm Bureau, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	
DC-CCCS-25.1.1.4	Action Step	Water Diversion/ Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	5	CDFW, Farm Bureau, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	
DC-CCCS-25.1.1.5	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders within Dry Creek tributaries willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	10	CDFW, NMFS, Sonoma County	
DC-CCCS-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
DC-CCCS-25.1.2.1	Action Step	Water Diversion/ Impoundment	Work with project proponents and landowners to implement instream habitat enhancement work along Dry Creek in addition to the 6 miles required by the NMFS 2008 Biological opinion, utilizing the Current Conditions Inventory and Conceptual Design work by Interfluve.	2	25	CDFW, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
DC-CCCS-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to estuary (impaired quality and extent)				

Dry Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
DC-CCCS-25.1.3.1	Action Step	Water Diversion/ Impoundment	Manage dam releases to minimize the influence on lagoon formation in support of the Russian River Biological Opinion.	2	5	CDFW, NMFS, USACE, Water Agencies	
DC-CCCS-25.1.3.2	Action Step	Water Diversion/ Impoundment	Encourage SCWA and Landowners along Dry Creek to coordinate water withdrawals in the interest of providing reliable releases from Lake Sonoma, and managing spring flow releases in support of efforts to maintain a freshwater lagoon in the estuary.	1	10	CDFW, NMFS, Sonoma County Water Agency, SWRCB	
DC-CCCS-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
DC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
DC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Develop and apply a distributed hydrologic water budget model to characterize surface stream flows within Russian River tributaries, to allow for comparisons between impaired and unimpaired conditions, with an emphasis on summer base flow conditions relative to rearing juvenile salmonids. These data will reduce uncertainty, provide greater temporal and spatial focus on impaired reaches and greater certainty for reaches that have water available for consumptive uses and be useful as a decision-support tool for other programs.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD	
DC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	To resolve frost protection/fisheries conflicts over spring baseflows evaluate alternatives such as: develop information about prioritizing tributaries and locations for offstream storage; develop criteria for sizing offstream storage; develop criteria making compensatory releases from large dams; provide policy and funding for the above actions to maximize benefits for fisheries and agriculture	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD, Water Agencies	
DC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Avoid and/or minimize the adverse effects of water diversion on salmonid habitat by establishing a more natural hydrograph, by-passing adequate downstream flows, regulating season of diversion, and promoting and implementing off-stream storage solutions (CDFG 2004).	1	25	CDFW, NMFS, Sonoma County	
DC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	5	CDFW, NMFS, SWRCB	
DC-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of Chinook salmon/steelhead and authorized diverters (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
DC-CCCS-25.2.1.6	Action Step	Water Diversion/ Impoundment	Support the development and implementation of groundwater use regulations.	3	10	CDFW, NMFS, SWRCB	
DC-CCCS-25.2.1.7	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	100	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
DC-CCCS-25.2.1.8	Action Step	Water Diversion/ Impoundment	Evaluate requests for on-stream dams above migratory reaches for effects on the natural hydrograph and spawning gravel recruitment downstream (CDFG 2004).	3	100	CDFW, NMFS, SWRCB	

Maacama Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Interior
- Spawner Abundance Target: 2,400 adults
- Current Intrinsic Potential: 76.2 IP-km

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

Abundance and Distribution

Although rigorous population estimates have never been conducted within the Maacama watershed, sporadic historical and anecdotal surveys indicate that steelhead were once abundant. Outmigrant trapping during May, 1965, documented abundant steelhead smolts captured at a perforated-plate trap located within mainstem Maacama Creek, approximately 5 miles above the Russian River confluence (CDFG 1965). The perforated-plate trap was checked on an almost daily basis, and over 1,100 juvenile steelhead were captured during the sampling period (maximum daily count of 165 steelhead). Spot surveys conducted by the California Department of Fish and Game (CDFG) during the 1990s documented the presence of 3 age classes of steelhead within a few of the larger Maacama subwatersheds, although steelhead abundance was largely depressed as compared to past surveys (Laurel Marcus and Associates 2004). Chinook salmon distribution and abundance within Maacama Creek are detailed within the Chinook profile for the Russian River population.

CDFW habitat surveys in the mid-1990s found steelhead distributed throughout much of the Maacama basin, the sole exceptions being high gradient headwater streams and areas upstream of migration barriers. Areas of higher quality habitat exist within upper Redwood Creek (Yellowjacket and Kellogg Creeks) where limited logging has allowed the historical coniferous-dominated upslope and riparian zones to remain. The McDonnell and Briggs Creek watersheds are largely devoid of agricultural operations that dominate the southern portion of the watershed, and contain large areas of quality rearing and spawning habitat (Laurel Marcus and Associates 2004).

History of Land Use

The predominant land use within the present-day Maacama Creek watershed is agriculture (largely vineyards), with smaller grazing and logging operations located within the northeastern portion of the watershed. Historically, agricultural development began as early as the 1850s within Knights Valley (Redwood Creek subbasin) and the Franz Creek watershed. Several timber and mining (silver and mercury) companies operated within the redwood and conifer-dominated headwaters of Redwood, Briggs and McDonnell Creeks during the late 1800s (Laurel Marcus and Associates 2004). In the early part of the century, cattle grazing was likely widespread throughout different areas of the basin, but now is largely restricted to northern watersheds, such as McDonnell Creek. However, the intensive grazing that occurred throughout the basin has led to an important change in grassland fauna, with annual European grasses replacing native perennial bunchgrasses. Native bunchgrasses better protect the landscape from erosion due to their deep and vigorous root system and their ability to regenerate following a fire (Laurel Marcus and Associates 2004).

Current Resources and Land Management

The entire Maacama Creek watershed is privately owned, except for small public holdings within the headwaters of McDonnell and Briggs Creeks (U.S. Bureau of Land Management). Consequently, resource management within the basin is largely carried out by private landowners with assistance from various Federal and state agencies (e.g., National Resource Conservation Service).

Salmonid Viability and Watershed Conditions

The following habitat attributes were rated Poor through the CAP process: habitat complexity, riparian vegetation, hydrology, and sediment transport. Recovery strategies will typically focus on improving these habitat attributes, although strategies that address other attributes may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

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

Estuary: Quality & Extent

Please see the Russian River Overview for a complete discussion.

Riparian Vegetation: Composition, Cover & Tree Diameter

Poor riparian conditions predominantly impact summer- and winter-rearing juveniles through elevated water temperatures and lack of velocity refugia respectively. Poor riparian conditions are common throughout much of the Maacama Creek watershed, elevating summer water temperatures, increasing stream bank erosion, and limiting LWD recruitment. Historical land clearing and logging effectively removed many of the larger redwoods/conifers that shaded headwater streams in many tributaries throughout the basin. As a result, few areas of conifer/redwood forests remain within the watershed (e.g., headwater sections of Briggs and Franz Creeks). Cattle grazing within the riparian corridor has likely lowered riparian function and diversity within the McDonnell Creek subbasin, also. Lower Maacama Creek has a wide riparian corridor (as compared to other tributaries in the basin) dominated by hardwood species. These lower elevation reaches, such as the mainstem Maacama Creek, likely did not support coniferous/redwood species historically.

Hydrology: Baseflow & Passage Flows

Low baseflows can reduce the quantity of habitat, elevate stream temperatures and inhibit movement between habitats for migration/emigration or to seek out food or temperature refugia during stressful periods through the disconnection of streams or riffle/pool complexes. Analysis by Laurel Marcus and Associates (2004) suggests that summer baseflows in Maacama Creek may be limiting steelhead survival within low-gradient stream reaches (i.e., <2% gradient). Adjacent to agricultural areas, summer baseflows flows are likely impacted during the summer irrigation season as well as the spring frost control period (Deitch *et al.* 2008).

Habitat Complexity: Large Wood & Shelter

Poor shelter values can limit juvenile steelhead survival. Data from CDFW habitat inventories indicate shelter ratings throughout the Maacama Creek watershed are poor within all sampled reaches. Poor to Fair LWD ratings were also documented within sampled reaches, due largely to a lack of functional riparian corridors and poor recruitment of large conifer species from adjacent upslope areas. The general lack of wood within Maacama Creek stream channels is likely a cause of the observed shelter deficiencies. Intense logging and land clearing around the latter half of the 19th century, combined with devastating wild fires during 1964 and 1965, shifted forest composition within much of the watershed from historical conifer/redwood stands to the current oak chaparral composite (Laurel Marcus and Associates 2004). This shift in forest type has likely lowered the volume of wood available for delivery into the stream environment.

Sediment: Gravel Quality & Distribution of Spawning Gravels

Poor gravel quality can impact egg development and lower juvenile rearing success. Although the CAP analysis indicated overall gravel quality as Fair, a few subwatersheds have spawning

gravel that is highly embedded with silt, which likely compromises spawning, egg incubation and macro-invertebrate food production (Laurel Marcus and Associates 2004). The Franz Creek watershed has High embeddedness ratings throughout most mainstem sections, likely the result of intensive agriculture development as well as landscape-level impacts resulting from a 1964 fire and subsequent 200-year flood event. Similarly, the McDonnell Creek watershed has some lower channel reaches that exhibit Poor embededdness ratings, in response to local sediment sources where livestock have access. Spawning gravel is limited within Foote Creek (CDFG 2006).

Water Quality: Temperature

High instream temperatures have the greatest impact on summer-rearing juvenile steelhead, and summer water temperatures are likely limiting steelhead survival throughout many sections of Maacama Creek, primarily within or downstream of stream channels with poor riparian canopy cover. The few areas noted as exhibiting cool water temperatures include the Briggs Creek and Kellogg Creek subwatersheds, isolated pool habitat within mainstem Bidwell Creek, and an area on lower Franz Creek that still retains a conifer/redwood-dominated riparian corridor.

Other Current Conditions

Compared to other watersheds within the Russian River basin, Maacama Creek likely has a moderately abundant population of steelhead that exhibit adequate life-history diversity. Several fish passage barriers occur within the watershed, but many of the higher priority sites have been addressed during the last several years. Although sediment from non-point sources such as roads is present in much of the watershed, the quantity of spawning-sized gravel does not appear to be a limiting factor in most streams.

Threats

The following discussion focuses on those threats that were rated as High or Very High (See Maacama Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts.

Agriculture

Agriculture operations encroach into adjacent riparian areas on Maacama Creek and can increase sediment delivery to the stream and decrease riparian shading and wood recruitment. Agriculture is focused mainly within the southwestern portion of the Maacama drainage, with an emphasis within the Knights Valley and Franz Creek sub-basin. Water diversions supporting viticulture in these areas likely lower summer baseflows. Low summer baseflows can disconnect aquatic habitat and elevate instream temperatures. To protect against frost damage to developing

grapes, farmers also pump/divert water during spring months, which has the potential to appreciably decrease downstream flows (Deitch *et al*. 2008).

Fire, Fuel Management and Fire Suppression

The Hanley Fire (1964) and PG&E #10 Fire (1965) burned large areas of the Maacama Creek drainage, and the effects of these two fires continue to substantially impair riparian and aquatic habitat throughout much of the basin (Laurel Marcus and Associates 2004). Following the fires, many areas failed to re-establish redwood/conifer dominated forests, resulting in a lack of LWD and adequate shade in most Maacama Creek tributaries. Furthermore, the flood event in 1965 that followed the fires precipitated severe erosion within the burned areas. The high instream sediment concentrations currently observed within portions of the Maacama drainage likely result from past fire damage. Most fires since the Hanley and PG&E #10 have been small by comparison (most burning 1% or less of the watershed area), suggesting that building fuel loads and the continuing rural nature of the basin could produce equally devastating wildfires in the future.

Livestock Farming and Ranching

Cattle grazing occurs throughout the basin and is the predominant land use within McDonnell and lower Briggs Creeks. Erosion and riparian deforestation have been documented within the watershed where overgrazing has occurred and riparian fencing is inadequate (Laurel Marcus and Associates 2004).

Roads and Railroads

Legacy roads from past logging and mining activity continue to impact the Maacama watershed. Road densities within higher elevation, conifer-dominated landscapes more than doubled between 1942 and 1961, largely the result of increased timber harvesting experienced throughout much of the basin during that period (Laurel Marcus and Associates 2004). Many of these roads were poorly built, not properly maintained, and have largely been abandoned.

Severe Weather Patterns

The Maacama Creek watershed exhibits a Mediterranean-type climate, with an annual rainfall range between 35 and 85 inches that falls predominantly between the months of October and April. Although winter and spring seasons can be relatively wet (especially within higher elevations), the summer and fall can be dry with daytime temperatures exceeding 100°F. Given that summer streamflow is already pressured by agricultural diversions, long-lasting drought patterns pose a significant threat to maintaining adequate streamflows and aquatic habitat.

Other Threats

Some streams have been channelized as part of agricultural or urban development, but the incidence of channelization is comparatively low given the small percentage of developed land within the basin versus other Russian River watersheds (e.g., Mark West Creek, Upper Russian River, and Santa Rosa Creek). Many streams become dry or intermittent during summer. This is a natural condition in some reaches, or could be the result of agricultural or municipal/private diversions, or a combination of both.

Limiting Conditions, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Maacama Creek watershed. Inadequate stream shading, low summer baseflows, elevated water temperatures, and high levels of inter-gravel sediment can limit benthic food production and juvenile survival. Additionally, roads and agricultural operations threaten watershed processes in the form of altering riparian resources, impairing hydrology, and sediment transport. Restoration actions should target addressing these issues within high habitat potential stream reaches.

General Recovery Strategy

Improve Riparian Conditions, Canopy Cover and LWD

Much of the Maacama Creek watershed would benefit from improved riparian composition and structure. This would increase stream shading, improve LWD recruitment, and improve instream shelter for juvenile fish. General practices to improve riparian condition include riparian planting and livestock exclusion fencing. Existing riparian corridors should be protected or improved through the establishment of conservation easements or other landowner incentive programs. This could provide a buffering from elevated temperatures and sediment runoff from adjacent land uses.

Address Upslope Sediment Sources

Abandoned logging and mining roads exist throughout the basin, but are especially numerous within the McDonnell and Briggs Creek sub-basins. Problem roads and active erosion sites should be prioritized and addressed as part of a comprehensive sediment reduction plan for the entire Maacama Creek basin.

Increase Instream Shelter Ratings and Pool Volume

Shelter ratings are Low within many surveyed stream reaches of Maacama Creek. Due largely to an absence of LWD, quality pool habitat is absent and shelter habitat is comprised mainly of

undercut banks and aquatic vegetation. Where applicable, restoration efforts should incorporate instream wood/boulder structures into degraded reaches to improve habitat complexity and shelter availability.

Investigate and Address Diversion and Groundwater Extraction

Low summer streamflow has been observed within tributaries of Maacama Creek. The source of these disconnected flow conditions should be investigated where low flows are affecting juvenile steelhead survival. If diversions and pumping are adversely affecting aquatic habitat, Federal, state and local government representatives should work with landowners to implement creative solutions that minimize these effects.

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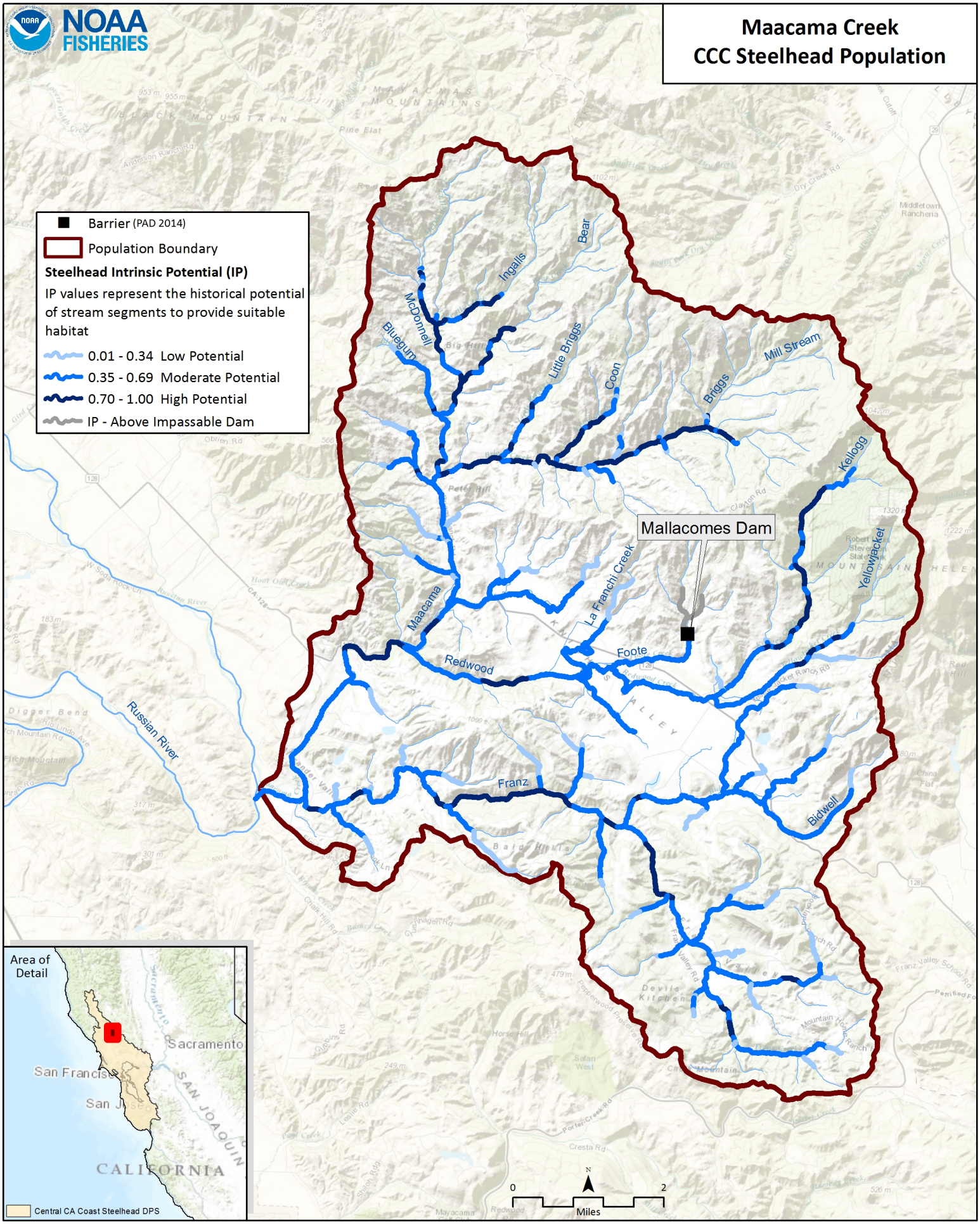
NOAA FISHERIES
Maacama Creek
CCC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
Mallacomes Dam
Bear
Ingalls
McDonnell
Bluegum
Little Briggs
Coon
Briggs
Mill Stream
Kellogg
Yellowjacket
La Franchi Creek
Maacama
Redwood
Foote
Franz
Bidwell
Russian River
Area of Detail
Sacramento
San Francisco
San Jose
SAN JOAQUIN
CALIFORNIA
Central CA Coast Steelhead DPS
0
2
Miles

CCC Steelhead Maacama Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% of streams/ 55% of 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)	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 75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	8% 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 to < low risk spawner density per Spence (2008)	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		>1 spawner per IP-km to < low risk spawner density per Spence (2008)	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 83	Poor
			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 66	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)	79% of streams/ 68% of 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% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	71% of streams/ IP-km (>40% average primary pool frequency)	Fair
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% of streams/ 55% of 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)	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 83	Poor
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 67	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	2.02 Diversions/10 IP-km	Fair
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	57% of streams/ 48 % of IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	8% 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)	79% of streams/ 68% of IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP-km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	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	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% of streams/ 55% of 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)	0% of streams/IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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	8% 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)	79% of streams/ 68% of IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	2.02 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 66	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.21% 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	8.475% 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	25-15% of Watershed in Timber Harvest in the past 10 years	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	2% of watershed > 1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	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	1.8 Miles/Square Mile	Poor

CCC Steelhead Maacama Creek CAP Threat Results

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

Maacama Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MaC-CCCS-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions				
MaC-CCCS-3.1.1.1	Action Step	Hydrology	Work with SWRCB and landowners to improve over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently impacted by water use.	3	10	NMFS, CDFW, RWQCB, SWRCB	
MaC-CCCS-3.1.1.2	Action Step	Hydrology	Improve connectivity of surface flows with groundwater, reduce aggradation, and lower the overall sediment load at the watershed scale by treating roads and sources of mass wasting.	2	100	CDFW, NOAA RC, Private Landowners, Sonoma County	
MaC-CCCS-3.1.2	Recovery Action	Hydrology	Improve passage flows				
MaC-CCCS-3.1.2.1	Action Step	Hydrology	Work with SWRCB and landowners to improve flow regimes for adult migration to spawning habitats and smolt outmigration.	2	10	NMFS, CDFW, Private Landowners, SWRCB	
MaC-CCCS-3.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
MaC-CCCS-3.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
MaC-CCCS-3.2.1.1	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	3	5	CDFW, NMFS, Private Landowners, SWRCB	
MaC-CCCS-3.2.1.2	Action Step	Hydrology	Install streamflow gauging devices to determine the current streamflow condition.	2	40	California Coastal Conservancy, CDFW, Private Landowners, RCD, Sonoma County	
MaC-CCCS-3.2.1.3	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	2	60	CDFW, NMFS, NMFS OLE, SWRCB	
MaC-CCCS-3.2.1.4	Action Step	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	20	CDFW, NMFS, NMFS OLE, SWRCB	
MaC-CCCS-3.2.2	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions				
MaC-CCCS-3.2.2.1	Action Step	Hydrology	Assess and map water diversions (CDFG 2004).	2	20	California Coastal Conservancy, CDFW, NMFS, NOAA RC, Private Landowners, Sonoma County	
MaC-CCCS-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
MaC-CCCS-5.1.1.1	Action Step	Passage	Improve fish passage at sites identified as partial or total barrier to anadromy. High priority tributary watersheds include Yellowjacket Creek and Kellogg Creek.	2	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
MaC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
MaC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches. Priority streams include Redwood Creek, Foote Creek, Kellog Creek, and Yellowjacket Creek.	2	100	CDFW, NOAA RC, Private Landowners	
MaC-CCCS-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-7.1.1	Recovery Action	Riparian	Improve tree diameter				
MaC-CCCS-7.1.1.1	Action Step	Riparian	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	10	Land Trusts	
MaC-CCCS-7.1.1.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate. High priority areas for consideration may include upper Briggs Creek and upper Bidwell Creek (Marcus 2004).	3	20	CDFW, NOAA RC, Private Landowners	

Maacama Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MaC-CCCS-7.1.2	Recovery Action	Riparian	Improve canopy cover				
MaC-CCCS-7.1.2.1	Action Step	Riparian	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs, across all counties where agriculture is a land use. Best management practices should include implementation of buffers and water conservation.	3	100	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MaC-CCCS-7.1.2.2	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, ivy, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	3	20	CDFW, NMFS, NOAA RC	
MaC-CCCS-7.1.2.3	Action Step	Riparian	Fence riparian areas within the Maacama Creek watershed from grazing by using fencing standards that allow other wildlife to access the stream. Combine fencing with appropriate riparian regeneration projects when possible. High priority streams include Bear, Ingall, McDonnell, Lower Briggs, Little Briggs, and Coon Creek (Marcus 2004).	2	10	CDFW, NOAA RC, NRCS, Private Landowners	
MaC-CCCS-7.1.2.4	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	100	CDFW, NMFS, NOAA RC, Private Landowners, RCD	
MaC-CCCS-7.1.2.5	Action Step	Riparian	Work with landowners to evaluate any existing conservation easements that exist within the Maacama watershed. Changes in these easements to better protect riparian habitat should be investigated (Marcus 2004).	2	5	CDFW, NMFS, NOAA RC, Private Landowners	
MaC-CCCS-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
MaC-CCCS-8.1.1.1	Action Step	Sediment	Complete a comprehensive sediment source inventory and assessment for the Briggs Creek sub-basin to address high road densities and grazing impacts.	3	2	CDFW, NMFS, NRCS, Private Landowners	
MaC-CCCS-8.1.1.2	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW or CalFire.	3	20	CalFire, CDFW, NMFS	
MaC-CCCS-8.1.1.3	Action Step	Sediment	Implement adequate monitoring to assess and track changes in bed profile and instream sediment levels within the Maacama Creek watershed.	3	10	CDFW, NMFS, Private Landowners	
MaC-CCCS-8.1.1.4	Action Step	Sediment	Establish at least one study reach on McDonnell Creek, Briggs Creek, Redwood Creek, Bidwell Creek and Franz Creek to evaluate changes to channel form and siltation levels (Marcus 2004).	3	10	CDFW, NMFS, Private Landowners	
MaC-CCCS-8.1.1.5	Action Step	Sediment	Use the v-star protocol over a broad area of each sub-basin on a regular basis to evaluate pool siltation (Marcus 2004).	3	10	CDFW, NMFS, Private Landowners, RCD	
MaC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
MaC-CCCS-12.1.1.1	Action Step	Agriculture	Reduce discharge of chemical effluent and fertilizer related to agricultural practices.	3	25	CDFW, NMFS, Private Landowners, RCD, RWQCB	
MaC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize alterations to sediment transport (road condition/density, dams etc.)				
MaC-CCCS-12.1.2.1	Action Step	Agriculture	Minimize future sediment and runoff sources from agricultural land by modifying actions that deliver sediment and runoff to stream channels.	2	100	CDFW, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MaC-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
MaC-CCCS-12.1.3.1	Action Step	Agriculture	Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to reduce sediment sources and improve riparian habitat within the Maacama Creek watershed.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MaC-CCCS-12.1.3.2	Action Step	Agriculture	Incentive programs and incentive-based approaches should be explored for landowners who conduct operations in a manner compatible with steelhead recovery requirements.	3	25	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MaC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
MaC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				

Maacama Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MaC-CCCS-12.2.1.1	Action Step	Agriculture	Develop legislation that will fund county planning for environmentally sound agricultural growth and water supply	2	10	CDFW, NMFS, RCD, Sonoma County	
MaC-CCCS-12.2.1.2	Action Step	Agriculture	Increase setbacks of existing agricultural activities from the top of bank to 100'	3	100	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MaC-CCCS-12.2.1.3	Action Step	Agriculture	Sonoma County should minimize conversion of open space, rangeland, or TPZ to vineyards or other agricultural uses that impact salmonids until a grading ordinance and land conversion ordinance are in place.	3	10	CDFW, NMFS, Sonoma County	
MaC-CCCS-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of existing regulatory mechanisms**				
MaC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
MaC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Avoid initiating backfires in streamside zones unless backfire will help protect streams and streamside zone from approaching wildfires – use backfires as a tool to protect streams and streamside zones from approaching wildfire.	2	100	CalFire	
MaC-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	If construction of fire lines involves falling trees near streams, dropping some into streams and/or stream-side zones is appropriate for short term LWD recruitment and erosion control.	3	100	CalFire	
MaC-CCCS-15.1.1.3	Action Step	Fire/Fuel Management	Obtain water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Mandate in equipment contract specs that water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	2	100	CalFire	
MaC-CCCS-15.1.1.4	Action Step	Fire/Fuel Management	Set up a comprehensive fire monitoring program that follows the guidelines in the National Park Service Fire Monitoring Handbook	2	5	CalFire	
MaC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize alterations to sediment transport (road condition/density, dams etc.)				
MaC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Do not remove or fell standing dead or apparently dying trees in stream-side zone. Upslope, felling and leaving these along the contour may intercept sediment and runoff.	3	100	CalFire	
MaC-CCCS-15.1.2.2	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire	
MaC-CCCS-15.1.2.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while fire fighters and fire fighting equipment are on site.	3	100	CalFire	
MaC-CCCS-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
MaC-CCCS-15.1.3.1	Action Step	Fire/Fuel Management	Minimize potential impacts from fire-related chemicals and retardants. Locate chemicals, petroleum products, latrines, camp sites, etc., as far from fish bearing streams and tributary watercourses as possible. Place on naturally flat ground.	3	100	CalFire	
MaC-CCCS-15.1.3.2	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	3	100	CalFire	
MaC-CCCS-15.1.3.3	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC steelhead and CC Chinook salmon.	3	100	CalFire	
MaC-CCCS-15.2	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
MaC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				

Maacama Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MaC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Ensure CDFW and NMFS participate on rehabilitation planning teams. During rehabilitation, consider leaving felled trees in streams as LWD source. Re-contour any massively modified areas. Storm-proof roads immediately after use. Where organic materials need disposal, windrow on disturbed soils on contour. Where larger organic material is available, place in severely burned-out watercourses (assure CDFW/NMFS is a part of this design and decision). Seeding, preferably with local seed-stock, at high hazard/risk areas should be done whenever feasible.	3	100	CalFire, CDFW, NMFS	
MaC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	3	100	CalFire	
MaC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MaC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
MaC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats. Develop a Salmon Certification Program for road maintenance staff.	3	3	CDFW, NMFS, Private Landowners, Sonoma County	
MaC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).	3	20	CDFW, NMFS, NOAA RC	
MaC-CCCS-23.1.1.3	Action Step	Roads/Railroads	NMFS and other stakeholders will work with RCD or NRCS to encourage landowners to conduct appropriate road assessments within high priority watersheds.	2	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
MaC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	2	CDFW, NMFS, Private Landowners	
MaC-CCCS-23.1.1.5	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. Sonoma County should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with steelhead and Chinook salmon habitat.	3	20	CDFW, NMFS, Private Landowners, RCD, Sonoma County	
MaC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
MaC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Conduct collaborative evaluations of priorities for treatment of CCC steelhead and CC Chinook salmon passage barriers, such as the Fish Passage Forum (CDFG 2004).	2	10	CDFW, NMFS, Public	
MaC-CCCS-23.1.2.2	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	100	Caltrans, CDFW, NMFS, Private Landowners, Sonoma County	
MaC-CCCS-23.1.2.3	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) must accommodate 100-year flood flows and associated bedload and debris.	2	100	Caltrans, Private Landowners, Sonoma County	
MaC-CCCS-23.1.2.4	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	Caltrans, CDFW, NMFS, Private Landowners, Sonoma County	
MaC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MaC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas. Decommission and rehabilitate riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses.	2	10	Caltrans, CDFW, Private Landowners, Sonoma County	
MaC-CCCS-23.1.3.2	Action Step	Roads/Railroads	Use best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	3	100	Private Landowners, Sonoma County	
MaC-CCCS-23.1.3.3	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	3	100	Board of Forestry, Private Landowners, RCD, Sonoma County	
MaC-CCCS-23.1.3.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	3	100	Board of Forestry, Private Landowners, Sonoma County	

Maacama Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MaC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
MaC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
MaC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific road management plan is created and implemented.	3	5	CDFW, NMFS, Sonoma County	
MaC-CCCS-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
MaC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MaC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	3	100	CDFW, NMFS, Private Landowners, SWRCB	
MaC-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	3	100	CDFW, NMFS, Private Landowners, SWRCB	
MaC-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	2	10	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
MaC-CCCS-24.1.1.4	Action Step	Severe Weather Patterns	Work with water managers on regulated streams to assure adequate and proper consideration is given to fish needs. Develop agreements that will minimize water-use conflicts and impacts on fish and wildlife resources during drought conditions.	2	20	CDFW, NMFS, Private Landowners, SWRCB	
MaC-CCCS-24.1.1.5	Action Step	Severe Weather Patterns	When feasible, use alternatives to water such as dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	2	20	CDFW, NMFS, Private Landowners, SWRCB	
MaC-CCCS-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
MaC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MaC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Develop and apply a distributed hydrologic water budget model to characterize surface stream flows within Russian River tributaries, to allow for comparisons between impaired and unimpaired conditions, with an emphasis on summer base flow conditions relative to rearing juvenile salmonids. These data will reduce uncertainty, provide greater temporal and spatial focus on impaired reaches and greater certainty for reaches that have water available for consumptive uses and be useful as a decision-support tool for other programs.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD	
MaC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	To resolve frost protection/fisheries conflicts over spring baseflows evaluate alternatives such as: develop information about prioritizing tributaries and locations for offstream storage; develop criteria for sizing offstream storage; develop criteria making compensatory releases from large dams; provide policy and funding for the above actions to maximize benefits for fisheries and agriculture.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD	
MaC-CCCS-25.1.1.3	Action Step	Water Diversion /Impoundment	Support efforts to provide improved localized weather prediction capabilities in support of finer scale frost protection capabilities for the benefit of grape growers and fisheries flows.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD	

Mark West Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Interior
- Spawner Density Target: 3,300 adults
- Current Intrinsic Potential: 164.2 IP-km

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

Abundance and Distribution

Systematic adult or juvenile fish surveys covering a substantial geographic area or time period have not been conducted within the Mark West population area (i.e., Mark West Creek, Santa Rosa Creek, and the Laguna de Santa Rosa), so accurately describing historic adult or juvenile fish abundance is difficult. However, anecdotal historical accounts and reports suggest steelhead were widely distributed and abundant throughout the population area. A 1953 survey of Mark West Creek noted abundant juvenile steelhead within the mainstem creek where flow persisted throughout the summer (Bruer 1953). In 1958, CDFW estimated that 5,000 steelhead returned to spawn annually within Santa Rosa Creek (CDFW stream report SR Creek). More recently, CDFW stream surveys during the late 1990s continued to document juvenile steelhead within most Santa Rosa Creek and Mark West Creek tributary reaches containing perennial flow, although densities were notably lower than those observed during surveys of the 1950s and 1960s (CDFG 1965; 1966; 1969; 1971). Similarly, snorkel and electrofishing sampling during the summers of 1999-2001 documented moderate numbers of juvenile steelhead within both Santa Rosa and Mark West Creek, with the highest densities occurring within headwater reaches (Sonoma County Water Agency 2002). Concerning adults, fyke-net sampling on both Santa Rosa Creek and Mark West Creek captured small numbers of steelhead (both upstream and downstream migrants) during the winters of 1993/94 and 1994/95 (Merritt Smith Consulting 1996). Overall, steelhead remain widely distributed within the Mark West population area, but at abundance levels that are likely significantly lower than those documented several decades prior.

History of Land Use

Intensive land management within the Santa Rosa Creek area started during the early 1800s, when Spanish settlers began grazing cattle and harvesting timber within suitable areas in the watershed. Agriculture also dominated early development within the area; hop fields and

orchards were common throughout lower elevation, undeveloped areas during the late 1800s and early 1900s. Urban development grew steadily following incorporation of Santa Rosa as a city in 1870 to such an extent that Santa Rosa was ranked as the 8th largest city in California by 1870. Population growth moderated somewhat during the early 1900s, but there was a marked increase following World War II. Today, small pockets of agriculture and cattle operations remain within the Mark West population area, but are largely restricted to more rural areas within the headwaters of Mark West and Santa Rosa creeks and low lying lands adjacent to the Laguna de Santa Rosa section of the watershed. Aside from the small footprint of agriculture and cattle grazing, much of the remaining watershed is currently heavily urbanized.

Current Resources and Land Management

The majority of the Mark West population area lies within incorporated areas and is largely under municipal management. Large, undeveloped private/public holdings exist within headwater reaches throughout the watershed (e.g., Saddle Mountain Preserve in upper Mark West Creek). The Mark West Creek, Santa Rosa Creek, and Laguna de Santa Rosa all contain substantial channelized stream reaches (i.e., flood channels), which are currently maintained by Sonoma County Water Agency (SCWA). The activities implemented by SCWA for flood control purposes include sediment removal, channel debris clearing, vegetation maintenance, and bank stabilization (Entrix Inc. 2004). SCWA also administers the Central Sonoma Watershed Project (CSWP), a series of flood control reservoirs located on Santa Rosa, Brush, Paulin, and Matanzas creeks. None of the on-stream CSWP reservoirs provide for upstream passage of adult or juvenile salmonids. The City of Santa Rosa's sub-regional wastewater system's main plant is located in the Laguna de Santa Rosa floodplain. The City owns and manages adjacent lands for storage and agricultural reuse and release of treated wastewater.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, riparian vegetation, sediment, velocity refuge, water quality, viability, and landscape disturbance. Recovery strategies will typically focus on improving these habitat attributes, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

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

Estuary: Quality & Extent

Please see the Russian River Overview for a complete discussion.

Habitat Complexity: Large Wood & Shelter

Adequate instream shelter is largely absent throughout most of the Mark West population area, and juvenile steelhead within these reaches experience reduced summer survival and growth due to poor LWD volume and shelter condition. The upper reaches of Mark West Creek and Santa Rosa Creek generally contain more shelter than lower urbanized reaches, although shelter levels in these upper reaches often fall below optimal levels (CDFG 2006a; 2006b). The heavily urbanized stream reaches lower in the watershed (e.g., those within the cities of Santa Rosa, Windsor, and Rohnert Park) exist mainly as flood control channels, and have been heavily armored and channelized to minimize flood risk. The large urban interface between the stream environment and upslope areas that traditionally supplied LWD impairs the potential for wood recruitment to the stream, translating into reduced shelter and instream habitat values. Furthermore, most large wood found within flood control channels is removed to further alleviate flood risk.

Velocity Refuge: Floodplain Connectivity

Floodplain connectivity is poor throughout much of the basin, especially adjacent to the urbanized floodplain where streams have been straightened and stream banks hardened to convey flows more efficiently to reduce flooding. Without access to flooded stream bank and riparian habitat, juvenile steelhead are flushed downstream to the river, or forced to reside within undesirable main-channel habitat where high flow velocities and low shelter likely limit winter survival.

Viability: Density, Abundance & Spatial Structure

The density and abundance of steelhead within the Mark West population area is greatly reduced from historical estimates (CDFW 2006a). However, spatial diversity is still high though smaller numbers of steelhead continue to persist throughout much of the Santa Rosa Creek, Mark West Creek, and Laguna de Santa Rosa subwatersheds.

Sediment: Gravel Quality and Distribution of Spawning Gravels

High levels of fine sediment can impair food production (Cordone and Kelley 1961; Suttle *et al.* 2004) and spawning success (Chapman 1988). The quantity and quality of instream gravel within the Mark West population area were rated Poor within the CAP workbook for both the egg and summer juvenile lifestages. During CDFW stream surveys, only 5 of 18 sampled tributaries were rated as Good or Very Good for embededdness, with 10 streams scoring a Poor rating (CDFW 2006a, CDFW 2006b). Within the Santa Rosa Creek watershed, a Rapid Biological Assessment

study demonstrated that all six tributary sampling reaches were impaired with regard to benthic macro-invertebrate density and diversity, likely caused by high instream sediment and poor water quality (Sustainable Land Stewardship Institute 2002).

Water Quality: Turbidity or Toxicity

Water quality is generally poor within the urbanized areas of the Mark West population area. Santa Rosa Creek (pathogens, sediment, temperature), Mark West Creek (sediment, temperature), and the Laguna de Santa Rosa (DO, mercury, nitrogen, phosphorus, sediment, temperature) are all listed as impaired on the Federal Clean Water Act Section 303(d) List for the various constituents identified. Recent water sampling by the Regional Water Board within lower Santa Rosa Creek (2008) documented high coliform and enterococcus levels near the downtown area. The cause of impairment is likely urban effluent arising from storm drains or faulty septic systems, wastewater discharge into the Laguna, or other point sources. Water quality is likely lowest during summer low flow conditions, when effluent discharge is more concentrated upon entering the stream system. Juvenile steelhead are most likely impacted by poor summer water quality; however, storm drainage following the first heavy rains of the season likely washes oil and chemicals from city streets into storm channels, possibly impacting adult and winter juvenile steelhead inhabiting the watershed at that time.

Riparian Vegetation: Composition, Cover & Tree Diameter

The composition and structure of riparian areas are rated Poor throughout much of the Mark West population area. CDFW stream habitat reports documented Good canopy values within only 3 of 18 sampled stream reaches, whereas 10 of 18 were rated as Poor (CDFW 2006a, CDFW 2006b). Many streams flowing through urban Santa Rosa, Windsor, and Rohnert Park have been channelized for flood conveyance, precluding connectivity between the stream, riparian corridor and floodplain. Non-native tree species, which are common in the urban setting, do not provide the natural functional benefits (e.g., shading efficiency, allochthanous input, etc.) necessary for rearing juvenile steelhead during summer months.

Landscape Patterns: Agriculture, Timber Harvest & Urbanization

Landscape disturbance alters structural and functional characteristics of the stream system, which can, in turn, upset the flow of energy between different biological communities occupying the "river continuum" (Vannote *et al.* 1980). Much of the Mark West Creek, Santa Rosa Creek, and Laguna de Santa Rosa watersheds are disturbed at the landscape scale, ranging from the large urban interface within the city of Santa Rosa and outlying municipalities to more benign land-use practices, such as agriculture and cattle grazing.

Other Current Conditions

Current stream flow patterns within Santa Rosa Creek and the Laguna de Santa Rosa likely deviate from historical patterns with higher flows during summer (due to wastewater discharge and urban runoff) and steeper winter storm hydrographs (due to high impervious surface area) within the watershed. Additionally, warm water temperature could limit juvenile steelhead survival during summer within some channelized sections of the population area although higher elevation headwater areas contain suitable water temperatures throughout the summer.

Threats

The following discussion focuses on those threats that were rated as High or Very High (See Mark West Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts.

Agriculture

Although many areas that once supported agriculture have been converted to urban development, agriculture continues as a dominant land use within the Mark West Creek watershed. As of 2002, 22 percent of the population area was in agriculture production, focused largely within the lower reaches of Santa Rosa Creek, Mark West Creek, and much of the Laguna de Santa Rosa (NMFS GIS). Land clearing and management associated with agriculture can increase erosion, confine stream channels, and limit riparian corridor extent and functionality.

Channel Modification

Flood control activities concomitant with the growing urban interface have simplified instream habitat complexity and disconnected many stream channels from their floodplains mostly through stream bank stabilization measures and channelization. As a result, riparian condition throughout urbanized portions of the watershed is generally poor, with lower densities of shade-producing trees, low LWD recruitment potential or residency, and a higher proportion of non-native invasive species which out-compete beneficial native riparian species. The SCWA has initiated a process to shift its stream maintenance program to improve riparian habitat and restore morphological function in the flood control channels to the degree possible.

Residential and Commercial Development

The 2010 census estimated the population within the Mark West Creek area at over 350,000 residents, the highest human population amongst the six Russian River steelhead populations, and over half the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS).

The high level of urban development has increased the impervious area within the watersheds, greatly impacting the hydrology and water quality.

Roads and Railroads

Road networks within the Mark West watershed are largely paved and associated with impervious surfaces within commercial and residential areas in contrast to the unpaved road systems common to rural watersheds with other land uses (e.g., logging, livestock ranching, or rural sub-divisions). As a result, much of the impacts resulting from Mark West area roads relate to road borne pollution (e.g., oils, urban runoff, etc.). Paved roads parallel many of the waterways within both Santa Rosa Creek and Laguna de Santa Rosa watersheds and the lower portion of Mark West Creek, while the headwaters of Mark West Creek are relatively rural in nature characterized by low to moderate road densities. These paved roads represent a significant source of the total impervious surfaces within the basin, and likely influence storm flow intensity and duration during winter.

Other Threats

Invasive fish species that prey on fry and juvenile salmon are likely problematic within the basin. Bass and various sunfish species have been found within areas characterized by slow, warm water. Efforts to eradicate these species could assist juvenile steelhead survival. Invasive aquatic plant species (e.g., *Ludwigia*) have become established within the Laguna de Santa Rosa, and provide ideal ambush habitat for predatory non-native fishes. Cattle grazing continues to occur within some of the more rural areas and may contribute to riparian degradation and increased erosion when fencing is not used to exclude animals from the stream environment. Low summer flows are common throughout many Mark West Creek tributaries, largely a result of upstream domestic and agricultural water diversions. Low summer baseflows likely lower juvenile steelhead survival by decreasing benthic invertebrate production and increasing predation and stranding risk (Sotoyome Resource Conservation District 2008).

Limiting Conditions, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer and winter juvenile and adult lifestages are likely most limiting steelhead productivity in the Mark West Creek watershed. Water quality is poor throughout the summer within many of the channelized stream reaches, largely as a result of poor canopy cover (elevated water temperatures) and urban/agricultural effluent entering the aquatic environment (excess macrophyte growth and increased toxin load). Over-wintering juvenile salmonid likely struggle to find suitable slow, off-channel and margin shallow-water habitat necessary to ensure high survival to the smolt lifestage. Adult steelhead likely encounter poor migratory habitat (e.g., few holding pools, excess flow velocity) throughout

the same channelized reaches, and the numerous road crossings throughout the watershed likely delay upstream migration to varying degrees.

General Recovery Strategy

Address Channelization to Reduce Habitat Fragmentation

The distribution of properly functioning aquatic habitat within the watershed is interrupted and disconnected by urban and agricultural land disturbance. The headwater reaches of Santa Rosa Creek, Mark West Creek, and tributaries to Laguna de Santa Rosa represent intact, relatively functional steelhead habitat, as do sections of the lower portion of the watershed. However, the middle portions are dominated by urbanized landscapes and channelized stream reaches, which offer little functional habitat for migrating, rearing or spawning steelhead. Creating set-back levees and reconnecting existing floodplain habitat within select sections of these streams would re-establish a continuum of functional steelhead habitat from headwaters to the lower end of the basin.

Improve Riparian Function and Composition

Poor riparian habitat is likely limiting steelhead productivity throughout many sections of the Mark West Creek watershed. Canopy cover was rated as sub-optimal canopy within fourteen of eighteen sampled reaches (CDFW habitat surveys), and LWD volume was similarly poor. Improving the function and composition by out-sloping channelized stream banks (widening riparian zones) and planting native species will not only improve canopy cover and water quality, but will improve LWD recruitment and increase the volume of wood-related cover in the stream channel.

Improve Instream Habitat Quality and Quantity

Poor instream habitat conditions are prevalent throughout much of the watershed, due to the degree of urban interface present within the Mark West Creek watershed and the effect this interface has on inhibiting recruitment of wood and gravel from upslope sources. Active restoration using structural measures will be required to address shelter values and pool: riffle ratios. Recovery actions should focus on improving spawning habitat through gravel augmentation projects and installing standard log/boulder habitat structures to increase adult spawning and juvenile rearing habitat.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a common problem throughout not only urban areas of the watershed, but headwater sections as well. Restoration actions should focus on identifying and

prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding.

Improve Hydrology and Baseflows

Water conservation projects, water right purchases, and conservation easements should be explored with willing landowners to protect and improve remaining flows and riparian/floodplain areas. Existing riparian/floodplain areas should be protected by adherence to County General Plan setback requirements and City ordinances where they exist, or developed where they do not.

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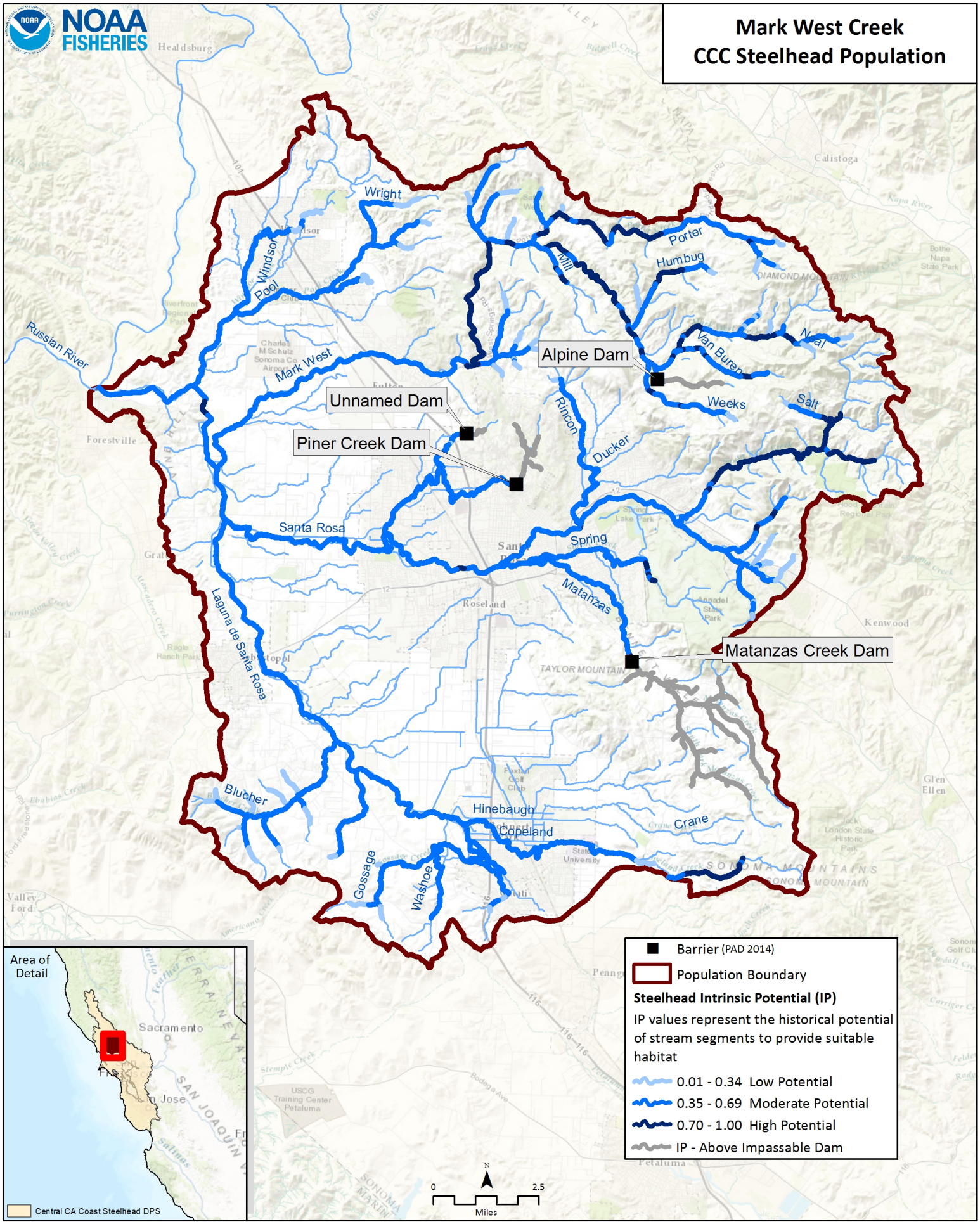
NOAA FISHERIES
Mark West Creek
CCC Steelhead Population
Healdsburg
Calistoga
Wright
Windsor
Pool
Russian River
Mark West
Porter
Humbug
Hill
Van Buren
Neal
Weeks
Salt
Alpine Dam
Unnamed Dam
Piner Creek Dam
Rincon
Ducker
Forestville
Santa Rosa
Spring
Matanzas
Roseland
Laguna de Santa Rosa
Matanzas Creek Dam
TAYLOR MOUNTAIN
Kenwood
Glen Ellen
Blucher
Hinebaugh
Copeland
Crane
Gossage
Washoe
SONOMA MOUNTAINS
Petaluma
Area of Detail
Sacramento
San Jose
Central CA Coast Steelhead DPS
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
N
0
2.5
Miles

CCC Steelhead Mark West Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	39% of streams/ 46% of 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 75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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	0% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Acute	Poor
			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 to < low risk spawner density per Spence (2008)	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		<1 Spawner per IP-km (Reference Spence)	Poor
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)	28% of streams/ 32% of IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	22% of streams/ 11% of IP-km (>40% average primary pool frequency)	Poor
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	39% of streams/ 46% of 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 67	Fair
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.18 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	95% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	50% of streams/ 40% of IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	0% 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)	28% of streams/ 32% of IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	39% of streams/ 46% of IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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	0% 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)	28% of streams/ 32% of IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.18 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 58	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	9.47% of Watershed in Impervious Surfaces	Fair

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	11.6% 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	25-15% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	55% of watershed >1 unit/20 acres	Poor
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	<25% Intact Historical Species Composition	Poor
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	5.5 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.2 Miles/Square Mile	Poor

CCC Steelhead Mark West Creek CAP Threat Results

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

Mark West Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MWC-CCCS-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
MWC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Improve over-winter survival by increasing the frequency and functionality of floodplain habitats.	2	20	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, Sonoma County, USACE	
MWC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, removal of levees, and use streamway concept where appropriate.	2	25	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, Sonoma County, USACE	
MWC-CCCS-2.1.1.3	Action Step	Floodplain Connectivity	Implement actions that re-establish the hydrologic connection between stream channels and adjacent floodplain habitat.	2	50	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, Sonoma County, USACE	
MWC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
MWC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	100	CDFW, NMFS, NOAA RC, Private Landowners	
MWC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Where feasible, increase woody cover in the pool and flatwater habitat units throughout the Mark West watershed, focusing on a combination of cover/scour structures constructed with boulders and woody debris within flatwater and pool locations. Work should be done in conjunction with stream bank stabilization to prevent erosion (CDFW habitat inventory reports).	2	20	CDFW, NMFS, NRCS, Private Landowners	
MWC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Where feasible, design and engineer pool enhancement structures to increase the number and quality of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion (CDFW stream habitat reports).	2	10	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-6.1.1.4	Action Step	Habitat Complexity	Many glide and run habitats should be converted to pools through the addition of large woody debris, especially within Mark West Creek tributaries (CDFW stream habitat reports).	2	20	CDFW, NMFS, NOAA RC, Private Landowners	
MWC-CCCS-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-7.1.1	Recovery Action	Riparian	Improve canopy cover				
MWC-CCCS-7.1.1.1	Action Step	Riparian	Fence riparian areas within the watershed from grazing by using fencing standards that allow other wildlife to access the stream.	2	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	100	CDFW, City of Rohnert Park, City of Santa Rosa, NMFS, NOAA RC, Private Landowners, Sonoma County	
MWC-CCCS-7.1.1.3	Action Step	Riparian	Focus riparian restoration within Santa Rosa, Matanzas, Brush/Rincon, Piner, Paulin, Windsor and Pool Creeks. Where appropriate, riparian surveys should be continued above CDFW survey sections. Santa Rosa Creek work should focus on survey reach 1 and the channelized section (CDFW habitat inventory report). Although passage barriers preclude steelhead from using much of the Matanzas Creek watershed, riparian restoration that addresses sediment and invasive plant sources within upper Matanzas Creek will likely improve habitat further downstream in Santa Rosa Creek.	2	25	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-7.1.1.4	Action Step	Riparian	Mark West Tributaries, specifically Humbug, Porter, Horse Hill and Weeks Creeks are other high priority creeks where riparian actions should be undertaken.	2	25	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-7.1.2	Recovery Action	Riparian	Improve tree diameter				

Mark West Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MWC-CCCS-7.1.2.1	Action Step	Riparian	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	10	Land Trusts	
MWC-CCCS-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
MWC-CCCS-8.1.1.1	Action Step	Sediment	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	2	CDFW, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-8.1.1.2	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW or CalFire.	3	20	CalFire, CDFW, NMFS, Private Landowners	
MWC-CCCS-8.1.1.3	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC steelhead and CC Chinook salmon recovery priorities.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
MWC-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
MWC-CCCS-10.1.1.1	Action Step	Water Quality	Determine site-specific recommendations, including incentives, to remedy high temperatures and implement accordingly (CDFG 2004).	2	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
MWC-CCCS-10.1.1.2	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	100	CDFW, NMFS	
MWC-CCCS-10.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants				
MWC-CCCS-10.1.2.1	Action Step	Water Quality	Assess and remove sources of toxins from watershed areas or streams.	2	10	CDFW, NMFS, RWQCB	
MWC-CCCS-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria				
MWC-CCCS-11.1.1.1	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas.	3	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
MWC-CCCS-11.1.1.2	Action Step	Viability	Utilize CDFW approved implementation, effectiveness, and validation monitoring protocols when assessing efficacy of restoration efforts.	3	100	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-11.1.1.3	Action Step	Viability	Monitor population status for response to recovery actions.	2	10	CDFW, NMFS, NOAA RC, Sonoma County Water Agency, UC Extension	
MWC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
MWC-CCCS-12.1.1.1	Action Step	Agriculture	Reduce discharge of chemical effluent and fertilizer related to agricultural practices.	3	25	CDFW, NMFS, Private Landowners, RCD, RWQCB	
MWC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize impairment to riparian species composition and structure				
MWC-CCCS-12.1.2.1	Action Step	Agriculture	Increase setbacks of existing agricultural activities from the top of bank to 100'	3	100	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-12.1.2.2	Action Step	Agriculture	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	3	100	CDFW, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				

Mark West Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MWC-CCCS-12.1.3.1	Action Step	Agriculture	Incentive programs and incentive-based approaches should be explored for landowners who conduct operations in a manner compatible with steelhead recovery requirements.	3	25	CDFW, Farm Bureau, NRCS, Private Landowners, RCD	
MWC-CCCS-12.1.3.2	Action Step	Agriculture	Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to reduce sediment sources and improve riparian habitat within the Mark West Creek watershed.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-12.1.3.3	Action Step	Agriculture	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	3	25	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacies of existing regulatory mechanisms**				
MWC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
MWC-CCCS-12.2.1.1	Action Step	Agriculture	Develop legislation that will fund county planning for environmentally sound agricultural growth and water supply	3	10	CDFW, NMFS, RCD, Sonoma County	
MWC-CCCS-12.2.1.2	Action Step	Agriculture	Limit salmonid habitat degradation resulting from conversion of forestland/open space to agriculture.	3	50	Board of Forestry, CalFire, Sonoma County	
MWC-CCCS-12.2.1.3	Action Step	Agriculture	Sonoma County should minimize conversion of open space, rangeland, or TPZ to vineyards or other agricultural uses that impact salmonids until a grading ordinance and land conversion ordinance are in place.	3	10	CDFW, NMFS, Sonoma County	
MWC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology				
MWC-CCCS-13.1.1.1	Action Step	Channel Modification	All proposed levees should be designed to account for minimal maintenance associated with an intact and functioning riparian zone.	2	100	FEMA, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-13.1.1.2	Action Step	Channel Modification	Where new levees, maintenance on existing levees, or similar flood control projects are planned, develop setbacks to allow the river to respond to natural hydrologic process and remain in equilibrium. At a minimum, setbacks should accommodate a 100 year event.	3	10	CDFW, Farm Bureau, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-13.1.1.3	Action Step	Channel Modification	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	2	30	CDFW, FEMA, NMFS, NOAA RC, Private Landowners, RCD, Sonoma County, USACE	
MWC-CCCS-13.1.1.4	Action Step	Channel Modification	Avoid or minimize the effects from flood control projects on salmonid habitat.	3	100	CDFW, FEMA, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-13.1.1.5	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	3	100	CDFW, NMFS, Private Consultants, Private Landowners, Sonoma County	
MWC-CCCS-13.1.1.6	Action Step	Channel Modification	Discourage stabilization projects which will lead to additional instability either up- or downstream.	3	100	CDFW, NMFS, Sonoma County, USACE	
MWC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
MWC-CCCS-13.1.2.1	Action Step	Channel Modification	Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow “emergencies”.	3	100	CDFW, NMFS, NRCS, Private Landowners, RCD, Sonoma County, USACE	
MWC-CCCS-13.1.2.2	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	3	100	CDFW, NMFS, NRCS, Private Landowners, RCD	
MWC-CCCS-22.1	**Objective**	**Residential/ Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance				
MWC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.	3	20	CDFW, City of Santa Rosa, NMFS, Sonoma County Water Agency	

Mark West Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MWC-CCCS-22.1.1.2	Action Step	Residential/ Commercial Development	Design and implement education programs to promote public awareness of salmon and steelhead habitat within urban creek settings.	3	5	CDFW, NMFS, Public, Sonoma County	
MWC-CCCS-22.1.1.3	Action Step	Residential/ Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating steelhead and Chinook salmon.	3	5	CDFW, NMFS, NOAA RC, Sonoma County Water Agency	
MWC-CCCS-22.1.1.4	Action Step	Residential/ Commercial Development	Implement performance standards in Stormwater Management Plans.	3	100	Private Landowners, Sonoma County	
MWC-CCCS-22.1.1.5	Action Step	Residential/ Commercial Development	New development in all historic CCC steelhead and CC Chinook salmon watersheds should minimize storm-water runoff, changes in duration, or magnitude of peak flow.	3	100	City of Rohnert Park, City of Santa Rosa, Sonoma County	
MWC-CCCS-22.1.1.6	Action Step	Residential/ Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	3	25	CDFW, City of Rohnert Park, City of Santa Rosa, NMFS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-22.1.1.7	Action Step	Residential/ Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.	3	100	CDFW, NMFS, Sonoma County	
MWC-CCCS-22.1.1.8	Action Step	Residential/ Commercial Development	Design new developments to avoid or minimize impact to unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC steelhead or CC Chinook salmon watercourse.	3	100	CDFW, City of Rohnert Park, City of Santa Rosa, NMFS, Sonoma County	
MWC-CCCS-22.1.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure				
MWC-CCCS-22.1.2.1	Action Step	Residential/ Commercial Development	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	50	CDFW, City of Santa Rosa, NMFS, Private Landowners, Public, Sonoma County	
MWC-CCCS-22.1.2.2	Action Step	Residential/ Commercial Development	Minimize development within riparian zones and the 100-year floodprone zones.	3	100	CDFW, City of Santa Rosa, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-22.1.2.3	Action Step	Residential/ Commercial Development	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	3	25	CDFW, Farm Bureau, Land Trusts, NMFS, NRCS, RCD, Sonoma County	
MWC-CCCS-22.1.2.4	Action Step	Residential/ Commercial Development	Counties and municipalities should adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	3	50	CDFW, City of Rohnert Park, City of Santa Rosa, NMFS, Sonoma County	
MWC-CCCS-22.1.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to watershed hydrology				
MWC-CCCS-22.1.3.1	Action Step	Residential/ Commercial Development	As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	3	5	CDFW, City of Santa Rosa, NMFS, Sonoma County	
MWC-CCCS-22.1.3.2	Action Step	Residential/ Commercial Development	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, and use streamway concept where appropriate.	1	25	CDFW, City of Santa Rosa, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-22.1.3.3	Action Step	Residential/ Commercial Development	Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical steelhead or chinook watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	25	CDFW, NMFS, Private Landowners	
MWC-CCCS-22.1.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MWC-CCCS-22.1.4.1	Action Step	Residential/ Commercial Development	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	3	100	City of Rohnert Park, City of Santa Rosa, Sonoma County	
MWC-CCCS-22.1.4.2	Action Step	Residential/ Commercial Development	Identify areas at increased risk of mass wasting and elevated fine sediment load, and decrease sediment from transportation projects and land management activities in those areas (CDFG 2004).	3	5	CDFW, NMFS, Sonoma County	

Mark West Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MWC-CCCS-22.1.4.3	Action Step	Residential/ Commercial Development	Minimize sediment from existing and future development to magnitudes appropriate to the geologic setting of the watershed	3	100	City of Rohnert Park, City of Santa Rosa, Private Landowners, Sonoma County	
MWC-CCCS-22.2	**Objective**	**Residential/ Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**				
MWC-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
MWC-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Toxic waste products from urban activities should receive the appropriate treatment before being discharged into any body of water that may enter any steelhead or Chinook salmon waters.	1	100	City of Rohnert Park, City of Santa Rosa, Public, Sonoma County, RWQCB	
MWC-CCCS-22.2.1.2	Action Step	Residential/ Commercial Development	Avoid or minimize the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	2	100	City of Rohnert Park, City of Santa Rosa, Sonoma County	
MWC-CCCS-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance				
MWC-CCCS-22.2.2.1	Action Step	Residential/ Commercial Development	Develop legislation that will fund county planning for environmentally sound growth and water supply and work in coordination with California Dept. of Housing, Association of Bay Area Governments and other government associations (CDFG 2004).	3	10	CDFW, City of Rohnert Park, City of Santa Rosa, NMFS, Private Landowners, Public, Sonoma County	
MWC-CCCS-22.2.2.2	Action Step	Residential/ Commercial Development	Discourage Sonoma County from rezoning forestlands to rural residential or other land uses.	3	20	CDFW, NMFS, Sonoma County	
MWC-CCCS-22.2.2.3	Action Step	Residential/ Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	100	City of Rohnert Park, City of Santa Rosa, Sonoma County	
MWC-CCCS-22.2.2.4	Action Step	Residential/ Commercial Development	Develop policy and guidelines that address land conversion and attempt to minimize conversion-related impacts within the aquatic environment.	3	20	CDFW, NMFS, Sonoma County	
MWC-CCCS-22.2.2.5	Action Step	Residential/ Commercial Development	Minimize new construction in undeveloped areas within the 100-year flood prone zones in all historic CCC steelhead and CC Chinook salmon watersheds.	3	5	CDFW, NMFS, Sonoma County	
MWC-CCCS-22.2.2.6	Action Step	Residential/ Commercial Development	Encourage Sonoma County to develop and implement ordinances (e.g., Santa Cruz) to restrict subdivisions by requiring a minimum acreage limit for parcelization and in concert with limits on water supply and groundwater recharge areas.	3	5	CDFW, City of Rohnert Park, City of Santa Rosa, NMFS, Sonoma County	
MWC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MWC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
MWC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats. Develop a Salmon Certification Program for road maintenance staff.	3	3	CDFW, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas. Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).	2	20	CDFW, NMFS, NOAA RC	
MWC-CCCS-23.1.1.3	Action Step	Roads/Railroads	NMFS and other stakeholders will work with RCD or NRCS to encourage landowners to conduct appropriate road assessments within high priority watersheds.	3	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
MWC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Use best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	3	100	Private Landowners, Sonoma County	
MWC-CCCS-23.1.1.5	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	3	100	Board of Forestry, Private Landowners, RCD, Sonoma County	

Mark West Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MWC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
MWC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources. Decommission and rehabilitate riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses.	2	30	Caltrans, CDFW, Private Landowners, Sonoma County	
MWC-CCCS-23.1.2.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	2	CDFW, NMFS, Private Landowners	
MWC-CCCS-23.1.2.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	3	100	Board of Forestry, Private Landowners, Sonoma County	
MWC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
MWC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Conduct collaborative evaluations of priorities for treatment of CCC steelhead and CC Chinook salmon passage barriers, such as the Fish Passage Forum (CDFG 2004).	2	10	CDFW, NMFS, Public	
MWC-CCCS-23.1.3.2	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) must accommodate 100-year flood flows and associated bedload and debris.	3	100	Caltrans, Private Landowners, Sonoma County	
MWC-CCCS-23.1.3.3	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Caltrans, CDFW, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-23.1.3.4	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	100	Caltrans, CDFW, NMFS, Private Landowners, Sonoma County	
MWC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
MWC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
MWC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. Sonoma County should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with steelhead and Chinook salmon habitat.	3	20	CDFW, NMFS, Private Landowners, RCD, Sonoma County	
MWC-CCCS-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
MWC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MWC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Develop and apply a distributed hydrologic water budget model to characterize surface stream flows within Russian River tributaries, to allow for comparisons between impaired and unimpaired conditions, with an emphasis on summer base flow conditions relative to rearing juvenile salmonids. These data will reduce uncertainty, provide greater temporal and spatial focus on impaired reaches and greater certainty for reaches that have water available for consumptive uses and be useful as a decision-support tool for other programs.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD	
MWC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	To resolve frost protection/fisheries conflicts over spring baseflows evaluate alternatives such as: develop information about prioritizing tributaries and locations for offstream storage; develop criteria for sizing offstream storage; develop criteria making compensatory releases from large dams; provide policy and funding for the above actions to maximize benefits for fisheries and agriculture	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD, Water Agencies	
MWC-CCCS-25.1.1.3	Action Step	Water Diversion /Impoundment	Support efforts to provide improved localized weather prediction capabilities in support of finer scale frost protection capabilities for the benefit of grape growers and fisheries flows.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD, Water Agencies	

Upper Russian River Population

CCC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Interior
- Spawner Abundance Target: 8,500 adults
- Current Intrinsic Potential: 423.9 IP-km

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

Abundance and Distribution

Although no statistically rigorous estimations of historic and current steelhead abundance exist for the Russian River watershed, the existing data does suggest a precipitous decline in abundance over the past several decades (see Russian River Watershed Overview). The number of steelhead currently distributed among the 6 different Russian River populations is unknown, although the distribution and quantity of available habitat within the basin suggest a high proportion originate from the Upper Russian River population discussed here. Juvenile steelhead abundance estimates exist from the 1960s and 1970s for some of the larger tributary systems, suggesting the Upper Russian steelhead population was much larger and widespread prior to the 1990s. For instance, the abundance of young-of-the-year steelhead in Forsythe Creek was estimated at 150-200 per 100 feet of stream length in 1963, whereas a more recent sampling in 1999 observed very low numbers of juvenile steelhead within the stream (CDFG 2006).

In 2003, the Sonoma County Water Agency (SCWA) conducted an "Upper Russian River Steelhead Distribution Study" to evaluate the distribution of steelhead during summer conditions and assess habitat along the Russian River (Cook 2003). Steelhead were observed in all 4 study reaches; however, their distribution and numbers varied substantially. Of 1,436 steelhead observed in the 37 sample segments between Ukiah and Healdsburg, steelhead were found in the upper portion of the Ukiah reach, throughout most the Canyon reach, and infrequently in the Alexander Valley and Healdsburg reaches. Steelhead comprised only <1% to 5% of all fish counted. The largest numbers of steelhead were observed in the Canyon reach at 265 steelhead/km followed by the Ukiah reach at 37 steelhead/km. The Alexander Valley and Healdsburg reaches had relatively few steelhead observations at <1 and 7 steelhead/km, respectively. Fish numbers were determined by visually counting fish during dive surveys and were not population estimates (Cook 2003).

Wild steelhead are widely distributed throughout the Upper Russian watershed, although passage barriers preclude access to some stream reaches. Since the 1980s, the Upper Russian River steelhead population has been augmented to a high degree through hatchery releases. Coyote Valley Fish Facility (CVFF) was constructed in 1991 and operates just below Coyote Valley Dam on the East Fork Russian River. The facility has an escapement goal of 4,000 adult steelhead and annually releases up to 200,000 steelhead smolts into the mainstem only (NMFS 2008). Additionally, surplus hatchery steelhead are relocated to numerous urban tributaries by volunteer of the Ukiah Rod and Gun Club through annual review and agreement by the California Department of Fish and Wildlife (CDFW) and NMFS biologists.

History of Land Use

Both Ukiah and Hopland, the two largest cities within the Upper Russian watershed, became incorporated in the 1850s. Early commerce and development revolved around agriculture, timber harvesting and cattle grazing, with hops and fruit trees representing the largest acreage of cropland. Cattle grazing likely occurred throughout much of the available low elevation, oak chaparral foothills not converted for agriculture or actively logged. The timber industry, which was largely concentrated within the redwood/conifer-dominated watersheds north and west of Ukiah, was a steady employer during the late 1800s and early 1900s, but it wasn't until the 1940s that the industry substantially surged. Today, although the urban footprint of Ukiah and Hopland has grown, much of the low-lying irrigable landscape remains in agricultural production (largely wine grapes, with smaller fruit tree orchards interspersed).

Current Resources and Land Management

The majority (90 percent) of the Upper Russian watershed is privately owned, with the remaining area comprising public lands administered by the U.S. Bureau of Land Management (8 percent), the U.S. Bureau of Indian Affairs, and the state of California. Mendocino Redwood Company (MRC) manages areas of Forsythe and Ackerman Creek for timber production (MRC 2012) and energy companies produce electricity from geothermal sources within the Big Sulphur Creek watershed (USBLM 2006). The majority of the Upper Russian watershed lies within Mendocino County, which is a partner within the 5 Counties (5C) Salmonid Conservation Program. Through the 5C Program, five participating counties (Humboldt, Del Norte, Trinity, Siskiyou, and Mendocino) work toward improving their plans, policies, and practices to improve or provide salmonid habitat (for more information, see http://www.5counties.org/). A major accomplishment was the development of the Five Counties Road Maintenance Program in 2007, which has established best management practices (BMPs) for urban and rural road management

and a programmatic assessment of all county managed roads and culverts between 2003 and 2005.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP analysis: tree diameter, floodplain connectivity, large wood frequency, shelter rating, gravel quality (embeddedness), canopy cover, temperature, estuary and lagoon quality and extent, percent primary pools, and riparian vegetation species composition. Recovery strategies will typically focus on improving these habitat attributes, although strategies that address other attributes may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

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

Estuary: Quality and Extent

Estuary rearing has been documented as an important life-history pattern for juvenile steelhead within coastal watersheds of the central coast of California, with higher survival rates associated with steelhead that rear within coastal lagoon habitat versus steelhead that rear exclusively within tributary habitat (Bond *et al.* 2008). Estuary conditions have a rating of Poor for summer rearing juvenile steelhead. For the last several decades, the Russian River estuary has been managed during the summer as an open, tidally-influenced estuary in order to alleviate flooding risks. However, the shift from a natural, perched-lagoon condition to a managed, open estuary condition has likely reduced summer rearing habitat quality and quantity (NMFS 2008). Please see the Russian River Overview for a complete discussion.

Habitat Complexity: Large Wood & Shelter

Logs and rootwads are important habitat-forming components within alluvial stream systems, and their juvenile steelhead are typically more abundant in streams with abundant woody debris. The volume of large woody debris is low throughout much of the Upper Russian watershed, as indicated by low large woody debris (LWD) volume in Ackerman, Jack Smith and Alder creeks (CDFW data). Nearly all stream habitat surveys conducted by CDFW within the Upper Russian watershed recommend restoration actions aimed at increasing shelter through placement of large wood within the stream channel.

Passage/Migration: Mouth or Confluence & Physical Barriers

Adult and juvenile steelhead passage is impaired within many tributaries in the basin, largely due to severe channel incision in the mainstem river that interrupts flow connectivity with tributary reaches (Coey *et al.* 2002). Coyote Valley Dam forms the largest impoundment within the system, effectively blocking upstream access into much of the East Fork Russian River. The Willow Water District Dam on the mainstem river precludes upstream passage at some flows. Numerous smaller dams and impoundments (often supporting agricultural and grazing operations) exist within tributary streams. Natural geothermal activity precludes steelhead utilization of upper Big Sulphur, and Vichy Creeks.

Velocity Refuge: Floodplain Connectivity

Inundated floodplain habitat provides high-quality rearing habitat for juvenile salmonids during winter and spring, which can improve growth rates and ultimately, long-term survival (Sommer *et al.* 2001; Jeffres *et al.* 2008). Smolt and adult steelhead utilize floodplain habitats for feeding and holding during winter months respectively. Floodplain connectivity is generally poor throughout much of the Upper Russian watershed. Stream channelization has straightened stream sections to increase flood conveyance in urban areas, impacting floodplain connectivity by physically isolating floodplain habitat from flood flows. As channelized streams tend to incise at a faster rate than unaltered stream channels, channel incision can lower streambed elevations, further isolating the channel from adjacent floodplain habitat. Removing aggregate through gravel mining has also caused severe incision within the Russian River mainstem, causing a "head cut" upstream into the lower portions of some tributaries. This condition is apparent within the lower sections of several mid-watershed tributary reaches including Robinson, McNab, and Morrison creeks (B. Coey, NMFS, personal communication, 2010).

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

The Upper Russian River CAP analysis rated shelter condition as Poor for summer rearing juveniles throughout much of the watershed; these conditions were likely a direct result of documented poor LWD volume (CDFW data). Habitat complexity created by submerged LWD likely comprised a large component of available shelter within streams located in forested landscapes of the upper river tributaries. As part of their stream habitat inventory program, CDFW recommended pool habitat restoration within all but three of the sampled tributaries of the Upper Russian watershed (Alder Creek, Orrs Creek, and Parsons Creek).

Sediment: Gravel Quality & Distribution of Spawning Gravels

Sediment conditions have a rating of Poor for the egg and summer rearing juvenile lifestages. High instream sediment levels impair steelhead survival throughout most Upper Russian tributaries and the mainstem Russian River. Only 39 percent of surveyed tributaries were rated

Good or better for embeddedness as part of CDFG's stream habitat inventory report, and high sediment concentrations within Coyote Valley Dam water releases degrade instream habitat quality and function within the Russian River mainstem upstream of Hopland (NMFS 2008). Spawning gravel quantity is not likely a limiting factor within upper tributary reaches since only three streams were noted as having limited spawning gravel during CDFG habitat surveys (Alder Creek, Orrs Creek, and Fisher Creek). However, the mainstem river in the area of Ukiah is a degraded reach, and the sparse riffle habitats are consistently used by spawning Chinook salmon and steelhead. Down-cutting occurs in lower tributary reaches near the confluence with the Russian River, as these lower tributary reaches scour to reach equilibrium with the degraded mainstem Russian River stream bed (SEC 1996). In those conditions, spawning gravel can be lost and the water table lowered. Forsythe Creek has downcut as much as 10 feet within the vicinity of the Highway 101 bridge since 1949 (SEC 1996).

Water Quality: Turbidity or Toxicity

Juvenile salmonids rely on sight feeding and likely have reduced growth rates due to the exposure to elevated turbidity. Flow releases from Lake Mendocino continue to cause elevated turbidity in the mainstem Russian River, and turbid discharges from Coyote Valley Dam can extend well past Hopland during summer months (J. McKeon, NMFS, personal communication, 2010). Releases from Lake Mendocino maintain turbid conditions for long periods of time, often maintaining higher than normal turbidity throughout the spring and summer months. Turbidity levels fall to lower levels as streams clear after winter storm events, ultimately resulting in deposition of suspended sediments. Turbidity may also affect food production and spawning gravels in the mainstem by increasing embeddedness as fine material settles into stream gravels.

Water Quality: Temperature

Steelhead presence is correlated with water temperature (Cook 2003). Survey site maximum temperatures in the Ukiah and Canyon reaches were 22 degrees C and 22.5 degrees C, respectively, which are above the 20.5 degrees C considered suitable temperature condition for young steelhead. The highest temperatures occurred in the Alexander Valley and Healdsburg reaches at 25 degrees C and 24 degrees C, respectively. These areas had the lowest steelhead density found in the survey. Prolonged exposure of steelhead at these temperatures may result in behavioral changes or mortality; however, steelhead observed by SCWA during Russian River dive surveys "appeared healthy and vigorous, and not stressed or lethargic from high water temperatures" (Cook 2003).

Hydrology: Baseflow and Passage Flows

Altered streamflow patterns likely decrease juvenile steelhead survival within the Upper Russian River watershed. Russian River water is released from Lake Mendocino (the reservoir formed by

CVD) for flood control and under the requirements of the State Water Resources Control Board's (SWRCB) Decision 1610 (D1610) for water supply. D1610 establishes minimum flow requirements for both Dry Creek and the Russian River. Minimum streamflows under D1610 are specified for four different reaches in the Russian River watershed, assuring high enough summer flows to meet the diversion requirements as well as river-based recreational uses.

The negative impact of Coyote Valley Dam releases on steelhead habitat has been well documented (SEC 1996; NMFS 2008) with high summer releases. These high flows create unsuitable water velocities for rearing fish. However, the Reasonable and Prudent Alternative being implemented as part of NMFS' biological opinion on Russian River water operations (NMFS 2008) requires the Sonoma County Water Agency to petition the state water board for lower mainstem flow requirements that will improve steelhead rearing conditions within the mainstem Russian River by 2016. Tributary reaches often experience the opposite effect during summer months as irrigation diversions and water impoundments appreciably lower tributary flows, causing loss of habitat and stranding. During late winter and early spring months, sudden, instantaneous diversions conducted to protect grape vines have dewatered reaches of stream and caused the loss of rearing juvenile steelhead (Deitch *et al.* 2008; NMFS 2009).

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian resources provide streamflow resiliency, sources of food, and a buffering effect, all of which reduce erosion and high summer temperatures for juvenile steelhead. However, an estimated 70 to 90% of Russian River riparian habitat has been lost since European colonization of the area (SEC 1996). Impaired riparian stability, often caused by stream bank armoring/clearing, invasive species establishment, or riparian grazing, has been identified as a limiting factor for salmonids within the Russian River (CDFG stream habitat reports). Riparian stability is an especially High threat within most of the west-side tributaries near Ukiah, such as Ackerman, Doolin, Orrs, and McNabb creeks (CDFG stream habitat reports). Cattle grazing within the riparian zones of Big Sulphur Creek has degraded riparian habitat function and increased erosion rates (Coey *et al*. 2002).

Viability: Density, Abundance & Spatial Structure

As discussed previously in the Steelhead Abundance and Distribution section, the density and abundance of steelhead within the Upper Russian population area are greatly reduced from historical estimates (CDFG reports). However, moderate numbers of steelhead continue to persist throughout much of Big Sulphur Creek and several of the larger tributaries draining the northwest portion of the watershed (e.g., Robinson, Ackerman, Forsythe, etc.).

Other Current Conditions

High instream temperatures during summer were noted as a limiting factor within several tributary systems, especially within the Big Sulphur watershed (CDFG habitat reports).

Threats

The following discussion focuses on those threats that were rated as High or Very High (See Upper Russian 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.

Agriculture

Although agriculture comprises only 8% of the land acreage of the Upper Russian River watershed, most agriculture operations occur in low-lying floodplains adjacent to the Russian River mainstem and tributaries, which worsens the severity of associated impacts. Many of the creeks in the Ukiah Valley are channelized to prevent flooding and erosion of adjacent farmland. This channelization can in turn lead to channel bed scouring and degradation. The down-cutting of streambeds within these alluvial fans, combined with agricultural water diversion and groundwater pumping, has likely contributed to the disconnected hydrology between headwater and mainstem reaches. Agriculture lands without cover crops can also contribute sediment into the stream channel during runoff periods.

Channel Modification

Several stream channels within the Ukiah area have been diverted out of their natural channels and now flow through flood control channels or road-side ditches (e.g., Orrs Creek and Doolin Creek). Flood control channels are often straightened and simplified, and usually feature some form of hardened bank stabilization that can impair the natural hydrologic and geomorphic stream processes that create and maintain diversified steelhead habitat.

Hatcheries

The CVFF releases up to 200,000 steelhead smolts as mitigation for lost habitat behind Coyote Valley Dam. Since steelhead reared in the Don Clausen Fish Hatchery (aka Warm Springs Hatchery, of which CVFF is a satellite facility) are no more divergent relative to the local natural populations than what would be expected between closely related populations within the DPS, these hatchery reared steelhead are listed as part of the CCC steelhead DPS (71 FR 834). Therefore, the risk of impacting the population via artificial propagation at the two hatcheries (e.g., genetic and demographic impacts, increased competition) is low. Wild fish are now introgressed into the hatchery population following a Hatchery and Genetic Management Plan.

Residential and Commercial Development

Although much of the Upper Russian watershed is rural and sparsely populated, the most heavily populated area (i.e., Ukiah and the surrounding area) is located within the most productive watersheds (e.g., Ackerman Creek, Forsythe Creek, and the West Fork Russian River). Prior to the advent of logging and intensive agricultural and urban development, these west-side streams were likely conifer-dominated watersheds with high quality habitat and frequent perennial flow.

Severe Weather Patterns

The Upper Russian watershed is characterized by a Mediterranean-type climate, with dry, hot summers and moderate rainfall that occurs primarily between November and March (Coey *et al.* 2002). Generally speaking, the east side of the watershed is likely drier than the west, as suggested by the difference in vegetation (i.e., the east-side is oak chaparral dominated; the west-side is generally conifer in higher elevations), with the noted exception being the high elevation areas in the Big Sulphur Creek drainage that regularly receive high rainfall amounts. Due to these drier conditions, the east side watersheds of the Upper Russian may be prone to a high incidence of wildfire during multi-year droughts. These conditions create temperatures and low flow periods that are on the extremes of preferred conditions for steelhead, and during drought periods, they make habitat conditions unsuitable.

Water Diversion and Impoundments

Several large impoundments impair steelhead migration on the mainstem within the Upper Russian River population, and numerous smaller dams preclude or impair steelhead migration into sections of the watershed. Water diversions can impact rearing steelhead during both summer and winter by lowering baseflows, stranding fish in isolated pool habitats or, in some cases, completely drying the stream channel. In addition to diversions from rural residential users, diversions from cannabis production has increased since California legalized medicinal use in 1996. Tributary streams, such as Feliz, Robinson, Seward, and the upper mainstem Russian River, have notable cannabis operations that contribute to reduced surface flow during the summer and fall months.

Other Threats

Finally, predation of wild steelhead juveniles by hatchery smolts is likely low, since most hatchery smolts migrate rapidly to the ocean following release (NMFS 2008). Road-related erosion can be a significant source of instream sediment within certain areas of the watershed (e.g., in the northwest corner where intensive logging has occurred). Geothermal energy production has degraded downstream water quality within certain sections of Big Sulphur Creek (Coey *et al.* 2002).

Limiting Conditions, Lifestages, and Habitats

Threat and condition analysis within the CAP analysis suggests summer and winter juvenile survival is likely a limiting factor affecting steelhead abundance within the Upper Russian River watershed. Poor riparian habitat condition and widespread channel incision have impaired floodplain-stream channel connectivity during high-flow conditions, likely resulting in low winter habitat volumes and correspondingly low juvenile survival rates. Survival through the summer rearing period is constrained by turbidity in early spring, and limited wetted habitat due to low streamflows and poor riparian shading likely elevate stream temperatures in summer. Restoration actions should target addressing these issues within the mainstem and high habitat potential stream reaches.

General Recovery Strategy

Improve Riparian Function, Canopy Cover and LWD volume

Re-establishing native riparian species in high priority riparian corridors will lower water temperatures, improve LWD recruitment, and limit bank erosion. Where appropriate, wood/boulder structures should be constructed and set within simplified stream reaches to scour pool habitat, sort spawning gravel, and create complex habitat.

Increase Instream Shelter Ratings and Pool Volume

Restoration efforts that place wood in streams and restore riparian function are needed to improve shelter ratings and pool volumes. Restoration of large wood in the upper mainstem Russian River below the East and West fork confluence should be investigated to create staging pools for migrating adults. This upper mainstem reach maintains consistent flow and temperature during the summer due to releases from Coyote Valley Dam. Improvement of instream cover and pool depths may provide improved juvenile rearing conditions and migration/holding habitat for adult salmonids in the fall and winter months.

Address Upslope Sediment Sources

Problem roads and active erosion sites already identified from existing road sediment surveys should be prioritized, and restoration actions should be implemented by Mendocino County Department of Transportation. Additionally, remaining roads (city, county, and private) within Sonoma and Mendocino counties should be addressed as part of a comprehensive sediment reduction and transportation plan for the entire basin. Future road construction should utilize BMPs to prevent altering watershed hydrologic processes, sediment transport, and fish passage, and avoid or minimize construction of roads within riparian zones. BMPs to prevent or minimize

sediment from entering into the stream environment from agriculture, road building and maintenance, and cattle grazing within riparian areas should be implemented.

Improve Water Quality: Turbidity

A feasibility study to address turbidity issues from Coyote Dam should be completed and solutions implemented by the USACE. One alternative could include installation of a multi-level outlet structure to minimize the discharge of suspended sediment during critical periods of the steelhead lifecycle.

Investigate and Address Channel Degradation in Tributaries and the Mainstem Russian River

Analysis of severe channel degradation (which has caused water tables to lower and has dewatered many of these channels) should consider whether site-specific or watershed-wide solutions will minimize channel degradation at affected sites. The need for gravel augmentation that would alleviate the lack of course sediment transport from the East Branch Russian River due to Coyote Valley Dam should be investigated.

Address Impaired Tributary Hydrology

Low tributary flows likely impair juvenile steelhead survival during both spring and summer, although the mechanism by which these flow effects manifest is different for each season and stream. In spring, acute streamflow pumping in response to frost events can cause rapid dewatering of the stream channel. Conversely, summer low flows are more of a chronic, long-term effect brought about largely by steady agricultural and residential stream diversions and well pumping. Restoration actions should foster coordination between landowners during low-flow conditions to minimize acute dewatering episodes, and encourage the use of alternative frost protection strategies (e.g., wind fans, off-channel reservoirs, etc.), many of which have already been successfully employed throughout the basin.

Increase Abundance and Distribution

Mitigation and enhancement goals exist for hatcheries, and the risks of artificial propagation are minimized as long as CDFW continues to follow the Hatchery and Genetic Management Plan. Recommendations include modifying the smolt release goals to proportionally increase the numbers of fish imprinted and released from CVFF, expanding the number of upper river spawners, improving the potential to meet CVFF adult enhancement goals, and decreasing the need for trucking adult surplus steelhead from Dry Creek to the upper river (B. Wilson, CDFW, personal communication, 2011).

Evaluate and Improve the Regulated Flow Structure

Current efforts between NMFS and the NWS California/Nevada River Forecasting Center, Monterey Weather Forecasting Office, the Office of Hydrologic Development (OHD), SCWA and the USACE seek to balance and sustain fisheries flows while maximizing reservoir capture of watershed runoff. These efforts involving forecast-based reservoir operations for flood control and conservation, modeling watershed runoff and improvement of atmospheric rainfall, and river forecasts to identify opportunistic periods for diversion and bypass should be supported. Based on this evaluation and information, work with the USACE to modify the "rule curve" associated with storage and releases from Coyote Dam in the interest of fisheries flows. USACE should continue to evaluate the effects of ramping on juvenile salmonids, and modify flow ramping rates to avoid stranding.

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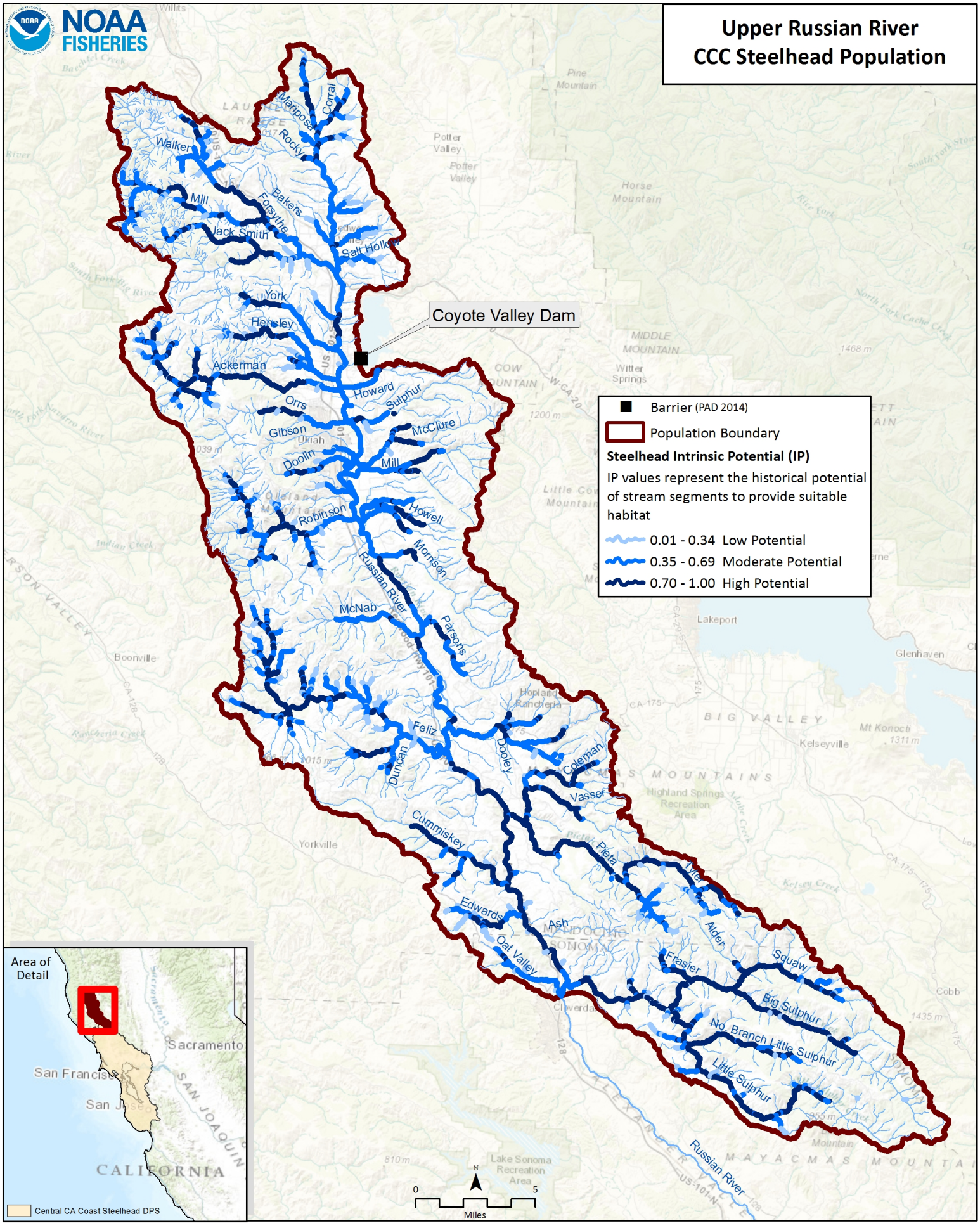
NOAA FISHERIES
Upper Russian River
CCC Steelhead Population
Coyote Valley Dam
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Central CA Coast Steelhead DPS
Sacramento
San Francisco
San Jose
CALIFORNIA
SAN JOAQUIN
Miles
0
5
Russian River
Mainstem
Mill
Jack Smith
Bakers
Forsythe
Salt Holler
Rocky
Corral
Mariposa
Walker
York
Hensley
Ackerman
Orrs
Gibson
Doolin
Howard
Sulphur
McClure
Robinson
Howell
Morrison
McNab
Parsons
Feliz
Duncan
Dooley
Coleman
Vasser
Cummiskey
Pieta
Edwards
Oat Valley
Ash
Alder
Frasier
Squaw
Big Sulphur
No. Branch Little Sulphur
Little Sulphur
Ukiah
Boonville
Yorkville
Lakeport
Kelseyville
Glenhaven
Potter Valley
Witter Springs
Hopland Rancheria
Highland Springs Recreation Area
Lake Sonoma Recreation Area
MAYACMAS MOUNTAINS
MIDDLE MOUNTAIN
BIG VALLEY

CCC Steelhead Upper Russian River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	25% 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)	22% of streams/ 43% of 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)	0.013% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Riparian Vegetation	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	7% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawner per IP-km to < low risk spawner density per Spence (2008)	>1 spawner per IP-km to < low risk spawner density per Spence (2008)	low risk spawner density per Spence (2008)		>1 spawner per IP-km to < low risk spawner density per Spence (2008)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	41% of streams/IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	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
			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)	25% 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)	43% of streams/ 20% of IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	22% of sreams/ 43% of 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)	0.013% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair

			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.9 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-Km to 74% of IP-km	Fair
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	43% of streams/ 20% of IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	7% 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)	41% of streams/IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	25% 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)	22% of sreams/ 43% of 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)	2.7 Diversions/10 IP-km	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	7% 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)	41% of streams/IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0.013% 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	1.9 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.846% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	5.583% 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	8% of watershed >1 unit/20 acres	Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	<25% Intact Historical Species Composition	Poor
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.5 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	0.3 Miles/Square Mile	Good

CCC Steelhead Upper Russian River CAP Threat Results

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

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge				
UR-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Reestablish the hydrologic connection between the stream channel and adjacent floodplain habitat. Work should be prioritized within Ukiah Valley downstream of Lake Mendocino (CDFW stream habitat reports).	2	15	CDFW, FEMA, Mendocino County, NMFS, Private Landowners, USACE	
UR-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as by: 1) hydrologically connecting floodplains with riparian forest; 2) removing or setting back levees; or 3) using the streamway concept where appropriate. Installing shelter components (LWD, boulders, etc.) appropriate to the channel type.	2	10	County Planning, FEMA, Private Landowners, USACE	
UR-CCCS-2.2	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**				
UR-CCCS-2.2.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
UR-CCCS-2.2.1.1	Action Step	Floodplain Connectivity	Minimize encroachment of landuse into existing floodplains.	3	20	CDFW, Cities, Counties, NMFS, USACE	
UR-CCCS-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
UR-CCCS-5.1.1.1	Action Step	Passage	Restore passage in high priority areas of the Upper Russian River Watershed as identified by CDFW, NMFS, the RCD, the County of Mendocino, Caltrans, and existing fish passage databases NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	1	10	CDFW, City Planning, County Planning, NMFS	
UR-CCCS-5.1.1.2	Action Step	Passage	Barriers on mainstem Russian River (memorial beach and Willow Water District Dam) should be assessed by a fish passage specialist and modified if needed.	1	10	CDFW, Mendocino County, NMFS, Sonoma County, Water Agencies	
UR-CCCS-5.1.1.3	Action Step	Passage	Barriers within Big Sulphur including Little Sulphur, Wildhorse, and Hummingbird Creeks should be assessed by a fish passage specialist and modified if needed. Several of these partial barriers have been impacted by nearby roads (CDFG 2002).	1	10	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-5.1.1.4	Action Step	Passage	Evaluate railroad stream crossing on McNabb Creek for salmonid passage and remediate if needed.	1	2	CDFW, NMFS, NOAA RC	
UR-CCCS-5.1.1.5	Action Step	Passage	Natural barriers on Alder, Anna Belcher, Frasier, Lovers Gulch and Squaw creeks should not be modified prior to consultation with NMFS and CDFW geneticists, in order to potentially protect resident rainbow trout populations (CDFG 2002).	3	2	CDFW, NMFS, NOAA RC	
UR-CCCS-5.1.2	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)				
UR-CCCS-5.1.2.1	Action Step	Passage	Investigate the need for fish ladders and resting pools/cover for migrating fish within tributaries near and within the City of Ukiah (CDFG 2002).	1	2	CDFW, NMFS, NOAA RC	
UR-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				
UR-CCCS-6.1.1.1	Action Step	Habitat Complexity	Complete habitat surveys within the West Fork Russian River watershed (CDFG 2002).	2	5	CDFW	
UR-CCCS-6.1.1.2	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-6.1.1.3	Action Step	Habitat Complexity	Encourage bio-engineering projects to address erosion issues on private lands.	2	3	CDFW, NOAA RC, NRCS, RCD	
UR-CCCS-6.1.1.4	Action Step	Habitat Complexity	Continue bio-engineering projects with adjacent landowners within the Forsythe Creek watershed (CDFG 2002).	3	3	CDFW, NOAA RC, NRCS, RCD	
UR-CCCS-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools				
UR-CCCS-6.1.2.1	Action Step	Habitat Complexity	Improve instream habitat complexity such that target criteria for primary and staging pool depths and shelter value is achieved within mainstem and tributary habitats utilized by salmonids. Priority streams would include Ackerman, Feliz, Robinson, Pieta and West Branch Russian River Creeks.	2	2	California Conservations Corps, CDFW, Private Landowners, Russian River Wild Steelhead Society, Trout Unlimited	

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-6.1.2.2	Action Step	Habitat Complexity	Enhance east branch and mainstem migration and resting habitats with LWD, boulders, and other instream features to increase habitat complexity and improve staging pool frequency and depth	2	25	CDFW, NMFS, NOAA RC, NRCS, RCD	
UR-CCCS-6.1.2.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features which provide stream complexity, pool frequency, and depth when evaluating permits for stream or bank modification.	3	100	CDFW, NOAA RC, Private Landowners	
UR-CCCS-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-7.1.1	Recovery Action	Riparian	Improve canopy cover				
UR-CCCS-7.1.1.1	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, ivy, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	2	20	CDFW, NMFS, NOAA RC	
UR-CCCS-7.1.1.2	Action Step	Riparian	Fence riparian areas within the Upper Russian River watershed from grazing by using fencing standards that allow other wildlife to access the stream.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-7.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	100	CDFW, NMFS, NOAA RC, Private Landowners, RCD	
UR-CCCS-7.1.1.4	Action Step	Riparian	Exclusion fencing and off-stream water development should be explored and implemented within the Big Sulphur watershed to address livestock damage in riparian areas. Initial efforts should target degraded conditions within steep south and west facing tributaries, such as the Squaw Creek sub-watershed, and within Little Sulphur and North Branch creeks.	2	5	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-7.1.2	Recovery Action	Riparian	Improve tree diameter				
UR-CCCS-7.1.2.1	Action Step	Riparian	Manage riparian areas for their site potential composition and structure.	3	100	Private Landowners	
UR-CCCS-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CDFW, NOAA RC, Private Landowners, RCD	
UR-CCCS-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
UR-CCCS-8.1.1.1	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW, or CalFire.	3	100	CalFire, CDFW, NMFS	
UR-CCCS-8.1.1.2	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC steelhead and CC Chinook salmon recovery priorities.	3	5	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-8.1.2	Recovery Action	Sediment	Improve quantity and distribution of spawning gravels				
UR-CCCS-8.1.2.1	Action Step	Sediment	Improve spawning gravel abundance within Alder Creek, Orrs Creek, and Fisher Creek (CDFW stream survey reports).	2	3	CDFW, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-8.1.2.2	Action Step	Sediment	Debris jams are potentially trapping sediment and eroding adjacent banks within Squaw Creek. The jams should be analyzed for possible removal or modification (CDFG 2002).	2	2	CDFW, NMFS	
UR-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-10.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment				
UR-CCCS-10.1.1.1	Action Step	Water Quality	Develop and fund a feasibility study to address the significant turbidity issues from Lake Mendocino outlet	1	2	Mendocino County, USACE	
UR-CCCS-10.1.1.2	Action Step	Water Quality	Fund and implement recommendations from proposed feasibility study to address significant turbidity issues from the Lake Mendocino outlet	1	5	Mendocino County, USACE, Water Agencies	
UR-CCCS-10.1.2	Recovery Action	Water Quality	Improve stream temperature conditions				
UR-CCCS-10.1.2.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade: increase the canopy by planting native species where shade canopy is not at acceptable levels.	2	20	CDFW, NMFS, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-10.1.2.2	Action Step	Water Quality	Explore releasing cooler flow out of Walker Dam (CDFG 2002).	2	2	CDFW, NMFS	

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-10.1.2.3	Action Step	Water Quality	Monitor instream water temperatures to determine baseline conditions and judge the efficacy of restoration actions. High priority streams include tributary and mainstem reaches within Big Sulphur Creek, Oat Valley Creek, Coleman Creek, Commiskey Creek, Gibson Creek, Johnson Creek, McDonald Creek, Morrison Creek, WB Russian River, Corral Creek, and Walker Creek (CDFW stream survey reports).	3	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria				
UR-CCCS-11.1.1.1	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas.	2	20	CDFW, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-11.1.1.2	Action Step	Viability	Utilize CDFW approved implementation, effectiveness, and validation monitoring protocols when assessing efficacy of restoration efforts.	3	100	CDFW, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize reduced density, abundance, and diversity				
UR-CCCS-12.1.1.1	Action Step	Agriculture	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with CCC steelhead and CC Chinook salmon recovery priorities.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-12.1.1.2	Action Step	Agriculture	Streamline permit processing where landowners are conducting actions aligned with recovery priorities.	3	5	CDFW, NMFS, NRCS, RCD, SWRCB, USACE	
UR-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance				
UR-CCCS-12.1.2.1	Action Step	Agriculture	Support and implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	10	CDFW, Farm Bureau, NMFS, Private Landowners, RCD	
UR-CCCS-12.1.2.2	Action Step	Agriculture	Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.	3	25	CalFire, CDFW, NMFS	
UR-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
UR-CCCS-12.1.3.1	Action Step	Agriculture	Encourage the NRCS, RCDs, and other appropriate organizations to increase the number of landowners participating in sediment reduction planning and implementation.	3	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-12.1.3.2	Action Step	Agriculture	Complete Farm Conservation Plans (through the RCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to address sediment source reduction, riparian habitat, forest health, and restoration.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology				
UR-CCCS-13.1.1.1	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	2	100	CDFW, Mendocino County, NMFS, Private Landowners, Sonoma County	
UR-CCCS-13.1.1.2	Action Step	Channel Modification	Discourage stabilization projects which will lead to additional instability either up- or downstream.	2	100	CDFW, Mendocino County, NMFS, Sonoma County, USACE	
UR-CCCS-13.1.1.3	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	3	100	CDFW, Mendocino County, NMFS, NRCS, Private Landowners, RCD, Sonoma County, USACE	
UR-CCCS-13.1.1.4	Action Step	Channel Modification	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	2	10	CDFW, FEMA, Mendocino County, NMFS, NOAA RC, Private Landowners, RCD, Sonoma County, USACE	
UR-CCCS-13.2	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms**				

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-13.2.1	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology				
UR-CCCS-13.2.1.1	Action Step	Channel Modification	Where new levees or similar flood control projects are planned, develop setbacks to allow the river to respond to natural hydrologic process and remain in equilibrium. At a minimum, setbacks should accommodate a 100 year event.	3	100	CDFW, Farm Bureau, Mendocino County, NMFS, Private Landowners, Sonoma County	
UR-CCCS-13.2.1.2	Action Step	Channel Modification	Minimize the effects of flood control projects or other channel modifications on steelhead habitat.	3	100	CDFW, FEMA, Mendocino County, NMFS, Private Landowners, Sonoma County	
UR-CCCS-13.2.1.3	Action Step	Channel Modification	Modify Federal, State, city and county regulatory and planning processes to minimize new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historic CCC steelhead and CC Chinook salmon watersheds.	3	10	CDFW, County of Mendocino, NMFS, Public, Sonoma County, State, Federal, Cities	
UR-CCCS-13.2.1.4	Action Step	Channel Modification	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.	3	2	CDFW, NMFS	
UR-CCCS-13.2.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
UR-CCCS-13.2.2.1	Action Step	Channel Modification	Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow “emergencies”.	2	100	CDFW, Land Trusts, Mendocino County, NMFS, NRCS, Private Landowners, RCD, Sonoma County, USACE	
UR-CCCS-13.2.2.2	Action Step	Channel Modification	Develop a mitigation policy that requires In-Kind replacement of removed large woody debris at a 3:1 ratio.	3	100	CDFW, NMFS, USACE	
UR-CCCS-13.2.3	Recovery Action	Channel Modification	Prevent or minimize adverse alterations to riparian species composition and structure				
UR-CCCS-13.2.3.1	Action Step	Channel Modification	All proposed levees should be designed to account for minimal maintenance associated with an intact and functioning riparian zone.	2	100	FEMA, Mendocino County, NMFS, Private Landowners, Sonoma County, USACE	
UR-CCCS-13.2.3.2	Action Step	Channel Modification	Counties and municipalities should adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	100	Mendocino County, Sonoma County	
UR-CCCS-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
UR-CCCS-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity				
UR-CCCS-16.1.1.1	Action Step	Fishing/Collecting	Modify Title 14, California Code of Regulations Section 8.00 (b) to include a low flow closure specific to the Russian River based on a minimum low flow of 350 cfs at the Department of Water Resources gauging station at Hacienda (HAC).	1	5	CDFW, NMFS, Public	
UR-CCCS-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to modify existing sport fishing regulations and the sport steelhead angling season to minimize impacts to steelhead.	2	5	CDFW, NMFS, Public	
UR-CCCS-16.1.1.3	Action Step	Fishing/Collecting	Increase enforcement and patrol during the steelhead and general fishing seasons in the upper and middle river area to reduce poaching.	2	5	CDFW, NMFS, Public	
UR-CCCS-17.1	**Objective**	**Hatcheries**	**Address other natural or manmade factors affecting the species' continued existence**				
UR-CCCS-17.1.1	Recovery Action	Hatcheries	Prevent or minimize reduced density, abundance, and diversity				
UR-CCCS-17.1.1.1	Action Step	Hatcheries	Manage Russian River Hatcheries following a Hatchery Genetic Management Plan (HGMP) which is regularly updated to include adaptive management strategies and recommendations.	1	5	CDFW, NMFS, USACE	
UR-CCCS-17.1.1.2	Action Step	Hatcheries	Evaluate the need for revising release numbers, release sizes, release locations and strategies in the context of meeting recovery goals and mitigation requirements of both Russian River Hatcheries (DCFH and CVFF). Update and revise the HGMP according to proposed changes and recommendations	2	5	CDFW, NMFS, USACE	
UR-CCCS-17.1.1.3	Action Step	Hatcheries	Preserve and manage the remaining genetic and phenotypic characteristics that promote life history variability in both hatchery and wild populations.	1	5	CDFW, NMFS, NOAA SWFSC, USACE	

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-17.1.1.4	Action Step	Hatcheries	Evaluate hatchery utilization in the context of increasing abundance and spatial distribution of steelhead in the Russian River and the larger CCC DPS.	1	5	CDFW, NMFS, USACE	
UR-CCCS-17.1.1.5	Action Step	Hatcheries	Increase the proportion of releases from Coyote Valley Fish Facility to expand and increase the numbers of upper river spawners	1	5	CDFW, NMFS, NOAA SWFSC, USACE	
UR-CCCS-17.1.1.6	Action Step	Hatcheries	If stocking is re-initiated, implement changes identified in Hatchery Genetic Management Plans to improve genetic and rearing management	1	5	CDFW, NMFS, USACE	
UR-CCCS-17.1.1.7	Action Step	Hatcheries	If stocking is re-initiated, conduct or increase the proportion of releases from Coyote Valley Fish Facility to expand and increase the numbers of upper river spawners	1	10	CDFW, NMFS, USACE	
UR-CCCS-20.1	**Objective**	**Mining**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-20.1.1	Recovery Action	Mining	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)				
UR-CCCS-20.1.1.1	Action Step	Mining	Continue to implement and support BMP's which improve, maintain or prevent impacts to habitat complexity when reviewing new mining plans.	2	5	CDFW, Counties, NMFS, Private Landowners, USACE	
UR-CCCS-20.1.1.2	Action Step	Mining	Develop and enhance staging pool habitats and thalweg depth where geomorphic conditions dictate and allow.	2	20	CDFW, Counties, NMFS, Private Landowners, USACE	
UR-CCCS-20.1.2	Recovery Action	Mining	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
UR-CCCS-20.1.2.1	Action Step	Mining	Retain LWD, boulders and vegetation on riffles where structure is beneficial to migration and resting cover.	2	20	CDFW, Counties, NMFS, Private Landowners, USACE	
UR-CCCS-20.1.2.2	Action Step	Mining	Develop and enhance offchannel habitats such as alcoves to promote fry and juvenile rearing habitat.	2	20	CDFW, Counties, NMFS, Private Landowners, USACE	
UR-CCCS-22.1	**Objective**	**Residential/ Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize reduced density, abundance, and diversity				
UR-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	Improve education and awareness of agencies, landowners and the public regarding salmonid protection and habitat requirements.	3	10	CDFW, Cities, Counties, NMFS, Private Landowners, Water Agencies	
UR-CCCS-22.1.1.2	Action Step	Residential/ Commercial Development	Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.	3	20	CDFW, Cities, Counties, NMFS	
UR-CCCS-22.1.1.3	Action Step	Residential/ Commercial Development	Design and implement education programs to promote public awareness of salmon and steelhead habitat within urban creek settings.	3	5	CDFW, Cities, Counties, NMFS, Public	
UR-CCCS-22.1.1.4	Action Step	Residential/ Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating steelhead and Chinook salmon.	2	5	CDFW, Cities, Counties, NMFS, NOAA RC, Water Agencies	
UR-CCCS-22.1.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance				
UR-CCCS-22.1.2.1	Action Step	Residential/ Commercial Development	As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	3	5	CDFW, Cities, Counties, NMFS	
UR-CCCS-22.1.2.2	Action Step	Residential/ Commercial Development	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, and use streamway concept where appropriate.	2	25	CDFW, Cities, Counties, NMFS, Private Landowners	
UR-CCCS-22.1.2.3	Action Step	Residential/ Commercial Development	Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical steelhead or chinook watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	25	CDFW, Counties, Land Trusts, NMFS, Private Landowners	

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-22.1.2.4	Action Step	Residential/ Commercial Development	Purchase conservation easements from landowners that currently have grazing or agricultural operations along the estuary.	2	10	California Coastal Conservancy, CDFW, Counties, NMFS, Private Landowners, RCD	
UR-CCCS-22.1.2.5	Action Step	Residential/ Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	3	25	CDFW, Counties, NMFS, Private Landowners, RCD	
UR-CCCS-22.1.2.6	Action Step	Residential/ Commercial Development	Design new developments to avoid or minimize impacts to unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC steelhead or CC Chinook salmon watercourse.	3	100	CDFW, Cities, Counties, NMFS	
UR-CCCS-22.1.2.7	Action Step	Residential/ Commercial Development	Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	50	CDFW, Cities, Counties, NMFS	
UR-CCCS-22.1.2.8	Action Step	Residential/ Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.	3	100	CDFW, Cities, Counties, NMFS	
UR-CCCS-22.1.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
UR-CCCS-22.1.3.1	Action Step	Residential/ Commercial Development	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100	Cities, Counties	
UR-CCCS-22.2	**Objective**	**Residential/ Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**				
UR-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize reduced density, abundance, and diversity				
UR-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Implement performance standards in Stormwater Management Plans.	3	100	Mendocino County, Private Landowners, Sonoma County	
UR-CCCS-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
UR-CCCS-22.2.2.1	Action Step	Residential/ Commercial Development	Avoid or minimize the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	2	100	Cities, Mendocino County, Sonoma County	
UR-CCCS-22.2.2.2	Action Step	Residential/ Commercial Development	Toxic waste products from urban activities should receive the appropriate treatment before being discharged into any body of water that may enter any steelhead or Chinook salmon waters.	2	100	Cities, Counties, Public, RWQCB	
UR-CCCS-22.2.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance				
UR-CCCS-22.2.3.1	Action Step	Residential/ Commercial Development	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	3	25	CDFW, Farm Bureau, Land Trusts, NMFS, NRCS, RCD, Sonoma County	
UR-CCCS-22.2.3.2	Action Step	Residential/ Commercial Development	Discourage Sonoma County from rezoning forestlands to rural residential or other land uses.	3	20	CDFW, NMFS, Sonoma County	
UR-CCCS-22.2.3.3	Action Step	Residential/ Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	100	Cities, Counties	
UR-CCCS-22.2.3.4	Action Step	Residential/ Commercial Development	Develop legislation that will fund county planning for environmentally sound growth and water supply and work in coordination with California Dept. of Housing, Association of Bay Area Governments and other government associations (CDFG 2004).	3	10	CDFW, Cities, Counties, NMFS, Private Landowners, Public	
UR-CCCS-22.2.3.5	Action Step	Residential/ Commercial Development	Minimize new construction in undeveloped areas within the 100-year flood prone zones in all historical CCC steelhead watersheds.	3	5	CDFW, NMFS, Sonoma County	

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-22.2.3.6	Action Step	Residential/ Commercial Development	Work with Mendocino County to develop more protective regulations in regard to exurban development (vineyard and rural residential).	3	10	CDFW, NMFS, RWQCB, SWRCB	
UR-CCCS-22.2.3.7	Action Step	Residential/ Commercial Development	Encourage Sonoma and Mendocino County to develop and implement ordinances (e.g., Santa Cruz) to restrict subdivisions by requiring a minimum acreage limit for parcelization and in concert with limits on water supply and groundwater recharge areas.	3	5	CDFW, Mendocino County, NMFS, Sonoma County	
UR-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
UR-CCCS-23.1.1.1	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	10	CDFW, County of Mendocino, NMFS	
UR-CCCS-23.1.1.2	Action Step	Roads/Railroads	Initiate road assessments and landslide mapping in the Forsythe Creek watershed (CDFG 2002).	2	5	CDFW, NMFS, NOAA RC	
UR-CCCS-23.1.1.3	Action Step	Roads/Railroads	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW, or CalFire.	3	100	CalFire, CDFW, NMFS	
UR-CCCS-23.1.1.4	Action Step	Roads/Railroads	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC steelhead and CC Chinook salmon recovery priorities.	3	5	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, RCD	
UR-CCCS-23.1.1.5	Action Step	Roads/Railroads	Upgrade Lowgap Road as per Mendocino County DOT evaluation.	2	5	CDFW, Mendocino County, NMFS, Private Landowners	
UR-CCCS-23.1.1.6	Action Step	Roads/Railroads	Implement recommendations outlined within the Eldridge Creek Road Survey.	2	10	CDFW, Mendocino County, NMFS, NRCS, RCD	
UR-CCCS-23.1.1.7	Action Step	Roads/Railroads	Debris jams are potentially trapping sediment and eroding adjacent banks within Squaw Creek. The jams should be analyzed for possible removal or modification (CDFG 2002).	2	2	CDFW, NMFS	
UR-CCCS-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
UR-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
UR-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC steelhead and CC Chinook salmon recovery needs.	2	20	Cities, Counties, Water Agencies	
UR-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Establish an emergency drought operations center (EDOC), (e.g., Washington Department of Fish and Wildlife, 2001), comprised of the SWRCB, CDFW, NMFS, and others to develop conservation measures for augmenting water supplies and mitigating the effects of drought on fish.	2	100	CDFW, NMFS, SWRCB	
UR-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Work with water managers on regulated streams to assure adequate and proper consideration is given to fish needs. Develop agreements that will minimize water-use conflicts and impacts on fish and wildlife resources during drought conditions.	2	20	CDFW, NMFS, Private Landowners, SWRCB	
UR-CCCS-24.1.1.4	Action Step	Severe Weather Patterns	Evaluate the rate and volume of water diversions and in streams and tributaries and, where appropriate, minimize water withdrawals that could impact steelhead and Chinook salmon. When feasible, use alternatives to water such as dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	2	20	CDFW, NMFS, Private Landowners, SWRCB	
UR-CCCS-24.1.1.5	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	2	100	CDFW, NMFS, Private Landowners, SWRCB, Water Agencies	
UR-CCCS-24.1.1.6	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	100	CDFW, NMFS, Private Landowners, SWRCB, USACE, Water Agencies	
UR-CCCS-24.1.1.7	Action Step	Severe Weather Patterns	Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	2	100	CDFW, NMFS, Private Landowners, SWRCB, Water Agencies	

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-24.1.1.8	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	2	10	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
UR-CCCS-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UR-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
UR-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Implement changes to D1610 as specified within the Russian River Biological Opinion (NMFS 2008).	1	15	CDFW, NMFS, Water Agencies	
UR-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	Support current efforts to balance and sustain fisheries flows while maximizing reservoir capture of watershed runoff. These efforts involving forecast-based reservoir operations for flood control and conservation, modeling watershed runoff, and improvement of atmospheric rainfall and river forecasts to identify opportunistic periods for diversion and bypass should be supported.	1	5	CDFW, NMFS, NOAA NWS, Private Landowners, SWRCB, USACE, Water Agencies	
UR-CCCS-25.1.1.3	Action Step	Water Diversion /Impoundment	Promote water conservation best practices such as drip irrigation for vineyards.	2	5	CDFW, Farm Bureau, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	
UR-CCCS-25.1.1.4	Action Step	Water Diversion /Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	5	CDFW, Farm Bureau, NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD	
UR-CCCS-25.1.1.5	Action Step	Water Diversion /Impoundment	Provide incentives to water rights holders within tributaries willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	3	10	CDFW, NMFS, Water Agencies	
UR-CCCS-25.1.2	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
UR-CCCS-25.1.2.1	Action Step	Water Diversion /Impoundment	Implement instream habitat restoration within the coldwater influence of the East Branch and along the mainstem Russian River (NMFS 2008).	2	10	CDFW, NMFS, USACE, Water Agencies	
UR-CCCS-25.1.2.2	Action Step	Water Diversion /Impoundment	Evaluate the potential and develop Safe Harbor Agreements for landowners participating in habitat enhancement along the mainstem and East Branch.	2	5	NMFS, Private Landowners, Water Agencies	
UR-CCCS-25.1.3	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to estuary (impaired quality and extent)				
UR-CCCS-25.1.3.1	Action Step	Water Diversion /Impoundment	Manage dam releases to minimize the influence on lagoon formation in support of the Russian River Biological Opinion.	2	5	CDFW, NMFS, USACE, Water Agencies	
UR-CCCS-25.1.3.2	Action Step	Water Diversion /Impoundment	Landowners along the East Branch should coordinate water withdrawals with Water Agencies, in the interest of providing reliable releases from Lake Mendocino, and managing spring flow releases in support of efforts to maintain a freshwater lagoon in the estuary.	1	10	CDFW, NMFS, SWRCB, Water Agencies	
UR-CCCS-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
UR-CCCS-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				

Upper Russian, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UR-CCCS-25.2.1.1	Action Step	Water Diversion /Impoundment	Develop and apply a distributed hydrologic water budget model to characterize surface stream flows within Russian River tributaries, to allow for comparisons between impaired and unimpaired conditions, with an emphasis on summer base flow conditions relative to rearing juvenile salmonids. These data will reduce uncertainty, provide greater temporal and spatial focus on impaired reaches and greater certainty for reaches that have water available for consumptive uses and be useful as a decision-support tool for other programs.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD	
UR-CCCS-25.2.1.2	Action Step	Water Diversion /Impoundment	Support efforts to provide improved localized weather prediction capabilities in support of finer scale frost protection capabilities for the benefit of grape growers and fisheries flows.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD, Water Agencies	
UR-CCCS-25.2.1.3	Action Step	Water Diversion /Impoundment	To resolve frost protection/fisheries conflicts over spring baseflows evaluate alternatives such as: develop information about prioritizing tributaries and locations for offstream storage; develop criteria for sizing offstream storage; develop criteria making compensatory releases from large dams; provide policy and funding for the above actions to maximize benefits for fisheries and agriculture.	1	5	CDFW, County Planning, Farm Bureau, NMFS, NOAA NWS, NOAA RC, NRCS, Private Landowners, RCD, Water Agencies	
UR-CCCS-25.2.1.4	Action Step	Water Diversion /Impoundment	Avoid and/or minimize the adverse effects of water diversion on salmonid habitat by establishing a more natural hydrograph, by-passing adequate downstream flows, regulating season of diversion, and promoting and implementing off-stream storage solutions (CDFG 2004).	1	25	CDFW, Counties, NMFS	
UR-CCCS-25.2.1.5	Action Step	Water Diversion /Impoundment	Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	5	CDFW, NMFS, SWRCB	
UR-CCCS-25.2.1.6	Action Step	Water Diversion /Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
UR-CCCS-25.2.1.7	Action Step	Water Diversion /Impoundment	Support the development and implementation of groundwater use regulations.	3	10	CDFW, NMFS, SWRCB	
UR-CCCS-25.2.1.8	Action Step	Water Diversion /Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	3	100	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB	
UR-CCCS-25.2.1.9	Action Step	Water Diversion /Impoundment	Evaluate requests for on-stream dams above migratory reaches for effects on the natural hydrograph and spawning gravel recruitment downstream (CDFG 2004).	3	100	CDFW, NMFS, SWRCB	

CCC Steelhead DPS Rapid Assessment Profile: Interior Diversity Stratum Populations

Crocker Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 25-52 adults
- Current Intrinsic Potential: 4.5 IP-km

Gill Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 41-84 adults
- Current Intrinsic Potential: 7.2 IP-km

Miller Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 17-35
- Current Intrinsic Potential: 3.1 IP-km

Sausal Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 65-131
- Current Intrinsic Potential: 11.1 IP-km

Abundance and Distribution

Limited sampling has documented low to moderate numbers of juvenile steelhead in Crocker Creek, Gill Creek, Miller Creek, and Sausal Creek; no monitoring has been done to document numbers of adult steelhead returning to these creeks to spawn.

CDFG conducted biological sampling along much of Crocker Creek in 1998 and reported finding juvenile steelhead at only one location, a site located downstream from an old KOA dam (CDFG 2006a). The dam, which was located about 0.6 miles from the creek's confluence with the Russian River, was subsequently removed in 2002 to promote upstream migration of adult steelhead. On June 14, 2007, NMFS staff surveyed stream habitat along a 1.2 mile contiguous segment of Crocker Creek and observed juvenile steelhead distributed throughout all but the very upstream end of the segment. One mile upstream from the mouth of Crocker Creek the stream's substrate is dominated by large boulders and a series of six foot high vertical waterfalls with very shallow pools for upstream migrants to jump from, suggesting that the boulder cascade and vertical drops

are not passable to upstream migrating steelhead at most or all flows (NMFS 2007). Therefore, this point is probably the upstream natural limit to anadromy (i.e., the upstream natural boundary of steelhead distribution in Crocker Creek).

CDFG (2006b) reports moderate abundance of juvenile steelhead at several sites on Gill Creek in 1998. This survey indicates that the best spawning and rearing habitat and highest numbers of juvenile steelhead in Gill Creek are in the middle portion of that creek and in its South Fork. However, for that survey, CDFG did not have landowner access to upper Gill Creek beyond a point 1,000 feet upstream from the creek's confluence with its South Fork. NMFS (2007), which surveyed stream habitat along 1.1 miles of non-contiguous reaches on Gill Creek on June 5, 2007, reported observing juvenile steelhead distributed throughout each of the reaches that it assessed.

CDFG last surveyed Miller Creek in July 2001. During that stream habitat inventory, fish sampling was not undertaken. The report for that habitat survey (CDFG 2006c) states that the Department of Fish & Game had previously conducted stream surveys of Miller Creek in October 1958 and August 1974. That 2006 report indicates that no fish were observed during the 1958 survey when flow was minimal, and it suggests that during the 1974 survey, flows were minimal and the spawning areas were highly silted; however, it provides no data on steelhead abundance or distribution for 1974. NMFS (2007) reports that juvenile steelhead were observed distributed throughout a 2.0 mile segment of lower Miller Creek that was inventoried on April 27, 2007. Both CDFG (2006c) and NMFS (2007) indicate that a 14-foot high, natural waterfall located 2.9 miles upstream from the Russian River is the upstream limit of anadromy on Miller Creek. Merritt Smith Consulting and Fawcett (2003) reported low densities of steelhead at index reaches in Miller Creek during the summers of 2000, 2001, and 2002, but that in the fall of those years steelhead were present only in 2001. Merritt Smith Consulting (2003) concludes that "oversummer survivorship" of steelhead was minimal in Miller Creek during those three years.

CDFG (1974) reports moderate to high densities of steelhead in Sausal Creek during early August 1974. They report 25 juvenile steelhead/100 feet of stream in Grapevine Creek and upper Sausal Creek, densities of about 100 juvenile steelhead/100 feet in Sausal Creek between the mouth of Grapevine Creek and the mouth of George Young Creek, and densities of 50 steelhead/100 feet of stream "from the mouth of George Young Creek downstream to where the creek dries up, ¼ mile above the Pine Flat Road Bridge." In the three years 2000-2002, Merritt Smith Consulting (2003) sampled the segment of Sausal Creek where CDFW earlier reported that the creek begins to annually dry up (i.e., in the vicinity of Pine Flat Road Bridge). Merritt Smith Consulting (2003) reports that this segment was intermittent by July in each of the three years, but that low to moderate levels of juvenile steelhead were present during both summer and fall surveys.

History of Land Use, Land Management and Current Resources

Crocker, Miller, Gill, and Sausal Creeks (together with Gird Creek) are the principal Russian River watersheds within Sonoma County's Alexander Valley, an area with a long history of agricultural production. The headwaters of these streams, which enter the east side of the Russian River between Cloverdale and Healdsburg, originate in the upland hills along the western edge of the Mayacama Mountains. During the first half of the 20th century, the Alexander Valley was known for its fruit production, primarily pears and prunes. During the past century, this area has also supported substantial cattle ranching and some sheep farming. Today these four small watersheds continue to support livestock grazing and viticulture although much of their headwaters are undeveloped mixed hardwood-conifer forest. During the late 1960s, Alexander Valley began to become an important center for the production of premium wine grapes. The valley currently supports about 15,000 acres of vineyards, most of which are in the lowlands bordering the Russian River; about 2,000 of these acres are within the Crocker, Gill, Miller, and Sausal Creek watersheds (Table 1).

Table 1. Acreage of vineyards, forest, grasslands and number of housing units in the Crocker Creek, Gill Creek, Miller Creek, and Sausal Creek watersheds.

Stream	Watershed Area (Acres)	Vineyard Acreage[1] (% watershed)	Grassland Acreage[2] (% watershed)	Forested Acreage[2] (% watershed)	Housing units in watershed[3]
Crocker Creek	2085	76 (4)	341 (16)	1677 (80)	94
Gill Creek	3654	230 (6)	855 (23)	2356 (65)	102
Miller Creek	3211	516 (16)	801 (25)	2016 (62)	21
Sausal Creek	8100	1163 (14)	2310 (29)	4123 (51)	47

[1]data from UC Hopland extension (2007)

[2]CA Department of Forestry (2002)

[3]Census 2000 Block data (migrated), CA Department of Forestry (2010)

NMFS (2007) reports that land use adjacent to the most downstream 0.25 mile segment of Crocker Creek (downstream from River Road) is primarily rural residential. They report that upstream from the River Road crossing, riparian encroachment from current land use activities is non-existent in the approximately 1.0 mile segment accessible to steelhead; however, the removal of the KOA dam has caused major bank failure that eliminated riparian canopy along two long

segments of Crocker Creek. NMFS (2007) reports that the most upstream 0.2 mile segment of Crocker Creek that is accessible to steelhead is in a canyon where riparian vegetation is dominated by mature trees and canopy closure is high. CDFG (2006a) states that the Crocker Creek watershed is privately owned and that most of the land surrounding the most upstream areas of the creek and its upper tributaries are managed as open grassland for livestock.

CDFG (2006b) states that the Gill Creek watershed is privately owned and managed for grazing and vineyards. Land use adjacent to the 600 foot segment of creek downstream from River Road is primarily viticulture. This lower segment is artificially channelized with levies and revetments on both banks (NMFS 2007). In contrast, along the approximately 0.6 mile long segment that ends 0.9 miles upstream from the Russian River, land use encroachment of the riparian zone is low, and riparian vegetation is dominated by either mature hardwoods with high canopy closure or by oak savannas (NMFS 2007). A substantial portion of the Gill Creek watershed (i.e., the segment beyond a point 1,000 feet upstream from the creek's confluence with its South Fork) has been inaccessible to public resource agencies, and thus the condition of stream habitats in the upper watershed is unknown.

CDFG (2006c) states that the Miller Creek watershed is entirely privately owned and is managed primarily for vineyard development, with some dispersed residential development. NMFS (2007), which surveyed the most downstream 2.0 miles of Miller Creek, confirmed that Miller Creek is closely bordered by vineyards especially in the lowermost 0.75 miles.

There is very limited information concerning land use within the Sausal Creek watershed. However, historically this watershed has supported livestock ranching and extensive viticulture.

Conditions

Impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on the conditions is abated. Using a Rapid Assessment Protocol and existing data, NMFS staff rated 12 potential habitat related conditions to determine their effect on five lifestages of steelhead (adult, eggs, summer rearing juveniles, winter rearing juveniles, and migratory smolts) in Crocker, Gill, Miller, and Sausal Creeks (See Interior Diversity Stratum Rapid Assessment Stress Results). The steelhead populations in these streams all face the same principal habitat conditions: a general lack of stream habitat complexity and impaired gravel quality. In addition, water diversions for small domestic use and agricultural irrigation probably appreciably diminish streamflow and the quality of steelhead habitat in Miller and Sausal Creeks. Consequently, the following conditions were rated as High for their effects on the steelhead populations in these watersheds: 1) Habitat Complexity: Large

Wood & Shelter, 2) Sediment: Gravel Quality & Distribution of Spawning Gravels, and 3) Hydrology: Baseflow & Passage Flows for summer rearing juveniles. Recovery strategies will focus on reducing these effects and improving conditions needed to ensure population viability and functioning watershed processes.

The following briefly summarizes information on those conditions that were rated as Fair or Poor for their effects on steelhead populations in these four watersheds:

Estuary: Quality & Extent
Please see the Russian River Overview for a complete discussion.

Riparian Vegetation: Composition, Cover & Tree Diameter
Riparian conditions in Crocker and Gill Creek are generally not altered to levels that pose more than a minor effect to steelhead. Riparian conditions are degraded in Miller Creek where the lower half of the stream is closely bordered by vineyards and canopy closure is low. The condition of riparian vegetation along the upper two-thirds of Sausal Creek has not been evaluated since CDFG's 1974 survey, but at that time riparian canopy was roughly only 40-50% along major segments. More recent information shows that lower Sausal Creek has been heavily channelized to an extent that the riparian vegetation is probably a Medium condition. However, riparian conditions in lower Sausal Creek have improved since 2004 when a riparian habitat improvement project removed giant reed (*Arundo donax*) and other invasive plant species, and native riparian species were planted. In addition, a stream bank stabilization project in 2007-2008 planted willow matting and reduced the bank slope along a reach of lower Sausal Creek.

Loss of high quality riparian vegetation can expose a stream to increased solar radiation, thereby increasing water temperatures beyond the tolerance of steelhead. CDFG (1974) describes water temperatures that exceed steelhead tolerance levels in segments of upper Sausal Creek. Low quality riparian vegetation can also reduce the supply of potential large woody debris, which plays an important role in creating rearing habitat for juvenile steelhead and temporary holding areas for adult fish.

Velocity Refuge: Floodplain Connectivity
Except for Crocker Creek, each of these streams has reaches where channel maintenance projects have disconnected significant portions of the stream from its floodplain. During the period 2004-2006, a levee was removed from a segment bordering Miller Creek, yet even after this work, NMFS (2007) reported that substantial portions of Miller Creek continue to be heavily channelized. Likewise, lower Sausal Creek is heavily channelized in its lower mile. Current conditions in much of the upper portions of Sausal Creek and its principal tributaries are not

known because landowners have precluded access for stream surveys during the past several decades.

Hydrology: Baseflow and Passage Flows

During summer, streamflows are exceedingly low or non-existent in much of Miller Creek and the lower two plus miles of Sausal Creek (CDFG 1974; Merritt Smith Consulting 2003; CDFG 2006c). Even in late April 2007, streamflow was discontinuous in the lower 0.6 miles of Miller Creek (NMFS 2007). State water right records indicate cancellation of applications for permits to store 3,285 and 700 acre-feet of water diverted from Sausal Creek and Miller Creeks, respectively, because of viticulture. The current status of water diversions in these watersheds is not known; however, about 15 percent of each of these watersheds is vineyards, which utilize approximately 2 acre-feet of water per cultivated acre.

In Crocker Creek and Gill Creek, crop irrigation and residential housing are not currently developed to a level that would cause moderate or major effects to streamflows. However, increased residential development could eventually impair summer streamflows in these two watersheds with resulting impacts to steelhead.

Habitat Complexity: Large Wood & Shelter

Years of farming practices and flood maintenance have resulted in the substantial loss of large woody debris (LWD) in each of the four focus watersheds in the Alexander Valley. CDFG (2006a, 2006b, and 2006c) and NMFS (2007) recommend adding large woody debris throughout Crocker, Gill, and Miller Creeks in order to increase complex cover (shelter) for fishes and channel scouring that deepens natural pools. The existing low level of instream cover directly reduces the quality of these streams as rearing habitat for juvenile steelhead. Channel simplification due to the loss of large woody debris and bank stabilization projects has also created high velocity flume-like environments during runoff events in the lower reaches of each of the four watersheds. Such high velocity conditions probably limit the number of days that adult steelhead can migrate up these creeks.

Sediment: Gravel Quality & Distribution of Spawning Gravels

Surveys of Crocker, Gill, and Miller Creeks indicate that major segments of these streams have high levels of fine sediment embedded in their gravel and cobble substrates (CDFG 2006a, 2006b, 2006c; NMFS 2007). CDFG (1974) and Merritt Smith Consulting (2003) indicate that the streambeds in lower and middle Sausal Creek also have detrimental levels of fine sediments.

Livestock, channel modifications, the proximity of roads that parallel each stream, and road crossings all likely contribute to stream bank erosion processes that have increased the load of

fine sediments in these streams. These sediments, which are composed mostly of sand, silt and clay particles, smother stream gravels and cobbles, diminish the capacity of the stream substrates to support steelhead egg incubation, and diminish the production of highly valuable aquatic invertebrates upon which steelhead feed. That loss of invertebrate production can directly impact growth rates and survival of rearing juvenile steelhead.

Conditions Rated as Fair or Good

Adverse hydrologic gravel scouring, impaired migration, altered pool frequency and pool/riffle ratio, impaired stream temperature, and impaired water quality associated with increased turbidity or toxicity are all rated as Fair or Good for their effects on steelhead. The most significant man-made obstacle to upstream passage of adults in these streams is the remnant of the "old River Road crossing" on Gill Creek (just downstream from the current crossing), where broken concrete and other debris pose a "severe impediment" to fish passage (NMFS 2007). In addition, stream channelization in the lower 2.0 miles of Miller Creek has greatly reduced the number and complexity of pools and left few resting spots for adult steelhead, so that upstream migration is probably limited to a narrow range of flows. Stream temperatures are generally suitable for steelhead in most of these creeks; although CDFG (1974) indicates that in Sausal Creek during early August when air temperature was 90ºF, water temperatures exceeded 80ºF at two points in the upper and middle segments of the creek (about 1000 feet below the confluence of Grapevine Creek and near the confluence of George Young Creek). They note that canopy closure was relatively low (40-50%) in these segments; however, there is no more recent survey data available for these reaches in Sausal Creek. Because there are insufficient data concerning levels of toxic materials (e.g., pesticides, fungicides, etc.) in all four of these streams, water quality monitoring for toxins is warranted, especially for Sausal, Miller, and Gill Creeks, which support considerable crop production.

Threats

The following discussion focuses on those threats rated as High (See Interior Diversity Stratum Rapid Assessment Threats Table). Recovery strategies will focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts.

Agriculture

Agriculture is an existing and future threat to steelhead populations in each of these small tributaries to the Russian River. Although only 4%-6% of the Crocker Creek and Gill Creek watersheds are developed as vineyards, this industry could potentially expand its acreage in these as well as the adjacent Miller and Sausal watersheds where vineyards already occupy about 15% of the acreage. This is a likely future threat given the high value of Alexander Valley grapes

and the continued increase in the number of wineries in this area. Viticulture and wineries often affect stream habitats by forcing streams into stabilized hardened channels by removing large instream woody debris for purposes of limiting natural flood processes that create and maintain quality steelhead habitat and by increasing erosion through the construction of roads and croplands that closely follow stream banks. Little is known about the seasonal concentrations of fungicides, herbicides, or pesticides in tributaries that flow through agricultural lands bordering the Russian River. Thus, it would be prudent to monitor the water quality of these streams to ensure that concentrations of common toxins associated with regional agricultural activities are not deleterious to steelhead.

The threat of agricultural water diversions and impoundments to steelhead is described below under the section Water Diversions and Impoundments.

Channel Modification

Channel modification (e.g., floodplain and riparian removal) has greatly impacted salmonid resources across the Interior Diversity Stratum and its watersheds. Simplification of streams through bank revetment and channel straightening disconnects streams from their floodplain. As a result, complex riffle-pool habitats needed by summer-rearing juvenile steelhead are lost. Likewise, winter rearing habitat is compromised when resident steelhead cannot find refugia from high velocities and are flushed from headwater reaches into marginal downstream habitat. Low velocity holding pools needed by migrating adult steelhead are also lost. In many areas, channel modification has caused channel incision, over-steepened banks, high erosional forces and gravel embeddedness, and ultimately loss of riparian trees.

The lower 0.3 miles of Gill Creek and the lower 2 miles of Miller Creek are channelized so that upstream migrating adults have few resting spots and rearing habitat is negligible. Little is known about current channel conditions in the perennial flowing portions of Sausal Creek or in the upper portions of Gill Creek (upstream from a point 1000 feet upstream from the confluence of Gill Creek's South Fork).

Livestock Farming and Ranching

Livestock grazing is known to adversely affect salmon and trout populations especially if cattle have access to and utilize riparian areas in large numbers for prolonged periods (Ballard and Krueger 2005). Depending on the period of time, and the numbers of animals utilizing these areas, cattle may adversely affect steelhead by disrupting spawning or feeding behaviors, trampling or smothering redds, and crushing individual juvenile salmonids. Livestock grazing can affect the riparian environment by changing and reducing vegetation or by eliminating riparian areas through channel widening, channel aggradation, or lowering the water table

(Armour *et al.* 1991). Moreover, the most apparent effects of livestock grazing on fish habitat are the reductions of shade, cover, and terrestrial food supply, and resultant increases in stream temperature and sedimentation through bank degradation and soil erosion. (Armour *et al*. 1991).

Livestock grazing is an ongoing threat to steelhead in both the Crocker Creek and Gill Creek watersheds (CDFG 2006a; 2006b; NMFS 2007); there are no records of livestock impacts to Miller Creek.

Residential and Commercial Development

Although residential housing density is currently low in the four watersheds, residential housing development is an ongoing threat to the steelhead populations in these streams. Residential development is typically accompanied by new roads, removal of riparian vegetation and habitat, increased stream sedimentation, and reduced summer flows. Water supply for rural housing typically comes from wells placed within a few hundred feet of streams. Such wells have the capacity to draw down aquifers and/or directly deplete the subterranean flow of streams. Average water use for a single family of four in California, including outdoor water use, is about 175,000 gallons per year (Consol Inc. 2010), or about 0.54 acre-feet of water per home. Any water supply for new homes near Crocker, Gill, Miller, or Sausal Creeks has a reasonable likelihood of affecting summer surface flows in these streams, even if by only a small amount. The construction of dozens of new homes near any of these creeks could cause a significant cumulative depletion of summer surface flows with resulting impacts to steelhead.

Roads and Railroads

Existing roads along Crocker, Gill, and Miller Creek adversely affect steelhead habitat. CDFG (2006a; 2006b; 2006c) all recommend that active and potential sediment sources related to the road systems in their respective study streams be mapped, and treated according to their potential to cause stream sedimentation. Likewise, NMFS (2007) specifically suggests that the box culvert at the River Road crossing on Crocker Creek should be replaced with a larger culvert or free span bridge, and the remnants of the old River Road crossing at Gill Creek should be removed to facilitate upstream passage of adult steelhead. In addition NMFS (2007) recommends an assessment of roads in the Gill Creek and Miller Creek watersheds to identify erosion treatment sites. The condition of roads in the Sausal Creek watershed also needs to be assessed to determine any needs for remediation.

Water Diversion and Impoundments

Water diversions for agricultural crop production are a likely ongoing threat to the recovery of steelhead in Miller and Sausal Creeks. About 15 percent of the Miller and Sausal Creek watersheds are currently managed vineyards, a crop that typically uses about 2 acre-feet of water

per year. Direct diversion of streamflow for heat protection and irrigation during dry summer months has the potential to significantly reduce surface flows and dewater salmonid rearing habitats. Diverting streamflows to storage during the relatively wet winter months for later use during the low flow season can also be deleterious if adequate bypass flows are not maintained. The magnitude of this threat is unclear because of very limited data concerning water diversion practices in these watersheds; however, given 1) the significant acreage of viticulture, 2) the approximately 2 acre-feet/acre water demand of viticulture, 3) that summer streamflows are generally very low (<1 cfs) in many stream segments, and 4) the near absence of precipitation during the months of June through October in most years, the diversion of streamflow is likely a significant threat to the steelhead populations in Miller and Sausal Creek. If crop production increases in Crocker or Gill Creeks, then those streams will probably also be threatened by the effects of increased water diversions.

Limiting Conditions, Lifestages, and Habitats

Our analysis of habitat-related conditions indicate that steelhead populations in Crocker and Gill Creeks are probably currently limited by the availability of juvenile rearing habitat and general lack of deep pools and other velocity refugia for winter migrating adult steelhead. High levels of sediment in the substrates of these streams may also affect steelhead densities by reducing the survival of incubating eggs, pool volume, and growth rates of juvenile fish deprived of a healthy macroinvertebrate forage base. The specific habitat conditions limiting the steelhead population in Miller creek are varied. The limited amount of quality rearing habitat is undoubtedly a major factor. Miller Creek has low availability of high quality pools with shelter for both juvenile rearing and migrating adults and high levels of fine sediments in its substrates. It also experiences extremely low flows probably in part due to irrigation practices in the watershed. Likewise, irrigation of about 14% of the Sausal Creek watershed may be having an effect on summer flows in this creek; however, there is a paucity of information on the status of steelhead and their habitats in Sausal Creek.

General Recovery Strategy

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

Efforts to recover steelhead populations in these four tributaries to the Russian River should focus on the following: (1) conserving (Gill and Crocker) and restoring (Miller and Sausal) streamflows; (2) restoring complex pool habitats by increasing large woody debris and/or boulder structures; (3) restoring the integrity of riparian habitats impacted by livestock grazing; and, (4) reducing the incidence of stream sedimentation by mapping and then treating road-related sediment sources. Those stream segments that contain properly functioning habitats for steelhead should be conserved and protected from activities that disconnect them from their floodplains or cause channelization or sedimentation.

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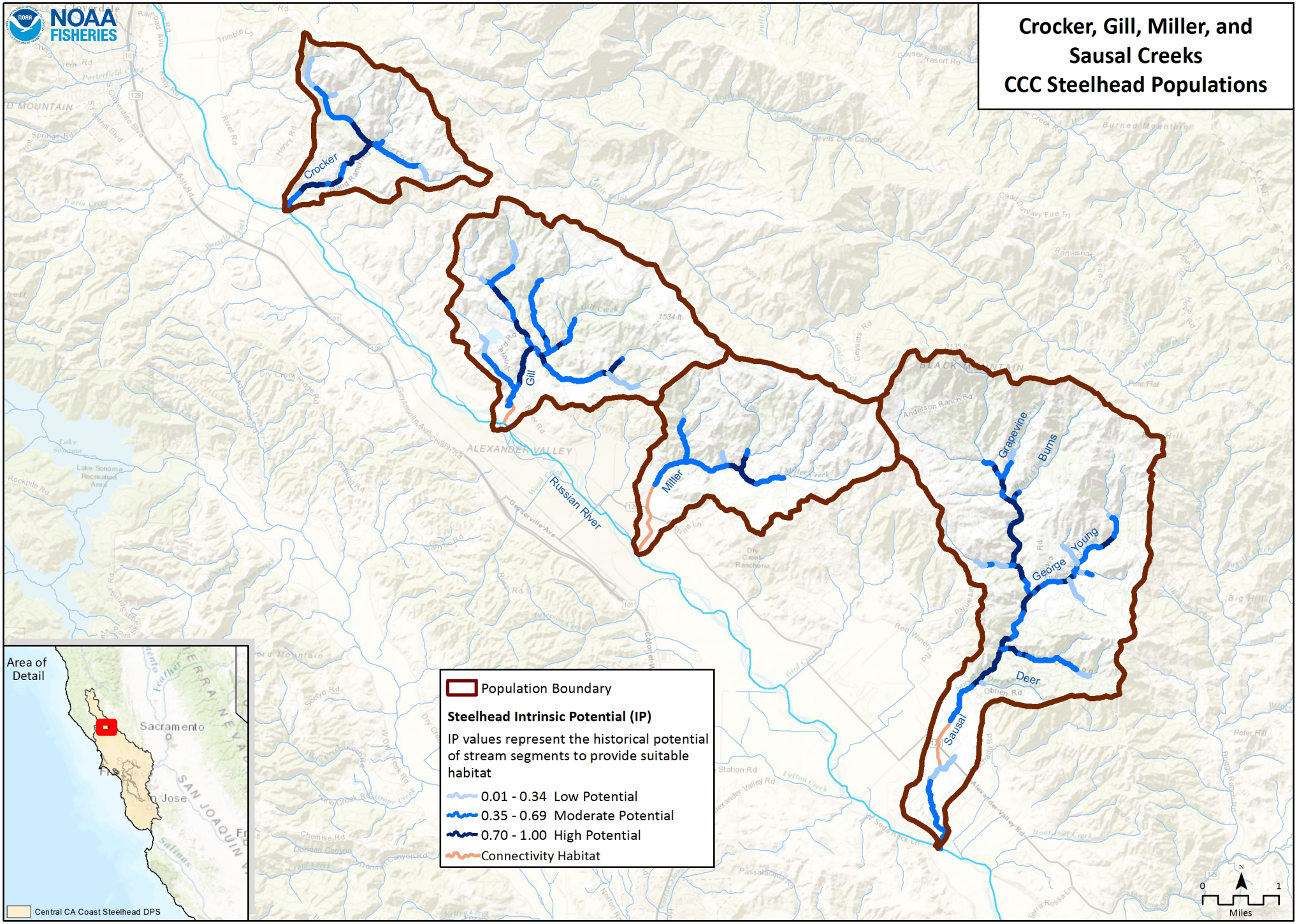

Coastal Multispecies Recovery Plan
Vol. IV, Central California Coast Steelhead

Rapid Assessment
Interior Diversity Stratum

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

CCC Steelhead DPS: Interior Stratum (Miller/Gill/Crocker/Sausal)													
Threat Scores **L: Low** **M: Medium** **H: High**		**Stresses**											
		Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Threats - Sources of Stress	**Agriculture**	M	L	M	L		L	M	M	H		L	L
	Channel Modification	M	L	H	M	M	H	H	H	H		M	L
	Disease, Predation, and Competition	L	L	L			L	L	L		L	L	L
	Fire, Fuel Management, and Fire Suppression	L	L	L	L		L	M	M	M		L	L
	Livestock Farming and Ranching	M	L	L	L		L	M	M	H		M	L
	Logging and Wood Harvesting	H	L	L	L		L	M	M	M		M	L
	Mining	L	L	L	L		L	L	L	L		L	L
	Recreational Areas and Activities	L	L	L	L		L	L	L	L		L	L
	Residential and Commercial Development	M	L	M	M		L	H	H	H		M	L
	Roads and Railroads	L	L	L	L		M	L	L	H		L	M
	Severe Weather Patterns	L	L	L	L	H	L	L	L	M		M	L
	Water Diversions and Impoundments	M	L	L	L	H	L	L	L	L	H	M	L
	Fishing and Collecting										L		
	Hatcheries and Aquaculture										L	L	L

Crocker Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CrC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CrC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
CrC-CCCS-13.1.1.1	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	2	10	CDFW, RCD, Sonoma County	
CrC-CCCS-13.1.1.2	Action Step	Channel Modification	Projects should seek alternatives to bank hardening and promote bioengineering solutions where feasible.	2	50	Private Landowners, RCD	
CrC-CCCS-13.1.1.3	Action Step	Channel Modification	Identify areas within modified channels where habitat features can be installed that provided shelter and velocity refuge for migrating steelhead.	2	5	CDFW, NOAA RC, RCD	
CrC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
CrC-CCCS-13.1.2.1	Action Step	Channel Modification	Sediment levels in Crocker Creek were exceptionally high in 2007 as a result of dam removal in 2001. Re-investigate sediment levels in the creek to determine whether it remains a significant impediment to steelhead recovery	2	3	CDFW, NMFS	
CrC-CCCS-13.1.2.2	Action Step	Channel Modification	If new surveys indicate that sedimentation remains a significant impact to steelhead habitat, develop and implement plans for controlling erosion and reducing sedimentation	2	5	CDFW, NOAA RC, RCD	
CrC-CCCS-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CrC-CCCS-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)				
CrC-CCCS-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from areas	3	10	CDFW, NCRWQB, NRCS, RCD	
CrC-CCCS-18.1.1.2	Action Step	Livestock	Plant vegetation to stabilize stream bank.	3	10	CDFW, NRCS, Private Landowners, RCD	
CrC-CCCS-18.1.1.3	Action Step	Livestock	Relocate instream livestock watering sources	3	20	CDFW, NRCS, Private Landowners, RCD	
CrC-CCCS-18.1.1.4	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	3	10	CDFW, NCRWQB, NRCS, Private Landowners, RCD	
CrC-CCCS-18.1.2	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
CrC-CCCS-18.1.2.1	Action Step	Livestock	Assess grazing impact on riparian condition, identifying opportunities for improvement.	3	25	NRCS, Private Landowners, RCD	
CrC-CCCS-18.1.2.2	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	3	10	CDFW, NRCS, RCD	
CrC-CCCS-22.1	**Objective**	**Residential/ Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CrC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
CrC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	Add large woody debris to reach optimal frequencies	2	5	CDFW, NRCS, Private Landowners, RCD	
CrC-CCCS-22.1.1.2	Action Step	Residential/ Commercial Development	Avoid the removal of large wood and other shelter components from the stream system	2	20	NRCS, Private Landowners, RCD	
CrC-CCCS-22.1.1.3	Action Step	Residential/ Commercial Development	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	10	NRCS, RCD	
CrC-CCCS-22.1.1.4	Action Step	Residential/ Commercial Development	Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors.	2	20	NRCS, Private Landowners, RCD	
CrC-CCCS-22.1.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
CrC-CCCS-22.1.2.1	Action Step	Residential/ Commercial Development	Minimize development within riparian zones and the 100-year floodprone zones.	2	20	NRCS, Private Landowners, RCD, Sonoma County	

Crocker Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CrC-CCCS-22.1.2.2	Action Step	Residential/ Commercial Development	Minimize new construction in undeveloped areas within the 100-year flood prone zones in all historical CCC steelhead watersheds.	2	20	Sonoma County	
CrC-CCCS-22.1.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure				
CrC-CCCS-22.1.3.1	Action Step	Residential/ Commercial Development	Establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.	2	10	NRCS, Private Landowners, RCD, Sonoma County	
CrC-CCCS-22.1.3.2	Action Step	Residential/ Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	20	NRCS, Private Landowners, RCD	
CrC-CCCS-22.1.3.3	Action Step	Residential/ Commercial Development	Re-establish native plant communities in riparian zones with a goal of increasing stream canopy to 80%	2	10	CDFW, NRCS, Private Landowners, RCD	
CrC-CCCS-22.1.3.4	Action Step	Residential/ Commercial Development	Work with private landowners to promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	3	20	NRCS, RCD	
CrC-CCCS-22.1.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CrC-CCCS-22.1.4.1	Action Step	Residential/ Commercial Development	Expand incentive program for rain collection systems.	2	5	CDFW, NCRWQB, NRCS, Sonoma County	
CrC-CCCS-22.1.4.2	Action Step	Residential/ Commercial Development	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	2	20	Sonoma County	
CrC-CCCS-22.1.4.3	Action Step	Residential/ Commercial Development	See WATER DIVERSIONS for specific actions and areas				
CrC-CCCS-22.2	**Objective**	**Residential/ Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**				
CrC-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure				
CrC-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	3	25	Sonoma County	
CrC-CCCS-22.2.1.2	Action Step	Residential/ Commercial Development	Enforce requirements of local regulations and riparian/setbacks	3	25	Sonoma County	
CrC-CCCS-22.2.1.3	Action Step	Residential/ Commercial Development	Increase monitoring and enforcement of illegal bank or shoreline stabilization activities.	3	50	Sonoma County	
CrC-CCCS-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CrC-CCCS-22.2.2.1	Action Step	Residential/ Commercial Development	Encourage the State Division of Water Rights to evaluate water rights compliance in all sub-watersheds where new development is proposed.	2	100	CDFW, NMFS	
CrC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CrC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
CrC-CCCS-23.1.1.1	Action Step	Roads/Railroads	All bridges associated with new roads and railroads or replacement bridges should be free span or constructed with the minimal amount of impairment to the stream channel.	2	20	CalTrans, Sonoma County	
CrC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CDFW, NCRWQB, RCD, Sonoma County	

Crocker Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CrC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Minimize placing new roadways within riparian zones.	3	100	Private Landowners, Sonoma County	
CrC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Replace problematic culverts and low flow crossings in Class 1 streams with bridges or appropriate cost effective designs.	2	10	CalTrans, Sonoma County	
CrC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
CrC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
CrC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Continue education of County road engineers and maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	2	20	Sonoma County	
CrC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	2	5	Sonoma County	
CrC-CCCS-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CrC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CrC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
CrC-CCCS-25.1.1.2	Action Step	Water Diversion/ Impoundment	Minimize new or increased summer diversions.	2	20	Private Landowners, Sonoma County, SWRCB	
CrC-CCCS-25.1.1.3	Action Step	Water Diversion/ Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	2	5	CDFW, NMFS, NRCS, RCD	
CrC-CCCS-25.1.1.4	Action Step	Water Diversion/ Impoundment	Work with partners to ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer or fall rearing reaches.	3	100	CDFW, NMFS, Sonoma County, SWRCB	

Gill Greek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GIC-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GIC-CCCS-10.1.1	Recovery Action	Water Quality	Improve stream water quality conditions				
GIC-CCCS-10.1.1.1	Action Step	Water Quality	Evaluate water quality below likely sources of contamination.	2	5	NCRWQB, NRCS, RCD, Sonoma County	
GIC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GIC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
GIC-CCCS-12.1.1.1	Action Step	Agriculture	Add large woody debris to reach optimal frequencies	2	5	NRCS, Private Landowners, RCD	
GIC-CCCS-12.1.1.2	Action Step	Agriculture	Avoid the removal of large wood and other shelter components from the stream system	2	20	Private Landowners	
GIC-CCCS-12.1.1.3	Action Step	Agriculture	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	5	CDFW, NMFS, NRCS, RCD	
GIC-CCCS-12.1.1.4	Action Step	Agriculture	Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors.	2	20	NRCS, Private Landowners, RCD	
GIC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GIC-CCCS-12.1.2.1	Action Step	Agriculture	Address agricultural activities that promote the delivery of sediment and runoff to stream channels.	2	5	NCRWQB, NRCS, RCD	
GIC-CCCS-12.1.2.2	Action Step	Agriculture	Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to reduce sediment sources and improve riparian habitat within the watershed.	2	20	Farm Bureau, NRCS, Private Landowners, RCD	
GIC-CCCS-12.1.2.3	Action Step	Agriculture	Promote agricultural practices that protect and restore CCC steelhead habitat by working with the agricultural community.	3	30	Farm Bureau, NRCS, RCD	
GIC-CCCS-12.1.2.4	Action Step	Agriculture	Work with vineyard owners to assess the effectiveness of erosion control measures throughout the winter period.	2	5	NRCS, RCD, Sonoma County	
GIC-CCCS-12.1.2.5	Action Step	Agriculture	Maintain adequate stream corridor buffers to filter and prevent fine sediment input from entering the creek	2	20	NRCS, Private Landowners, RCD	
GIC-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure				
GIC-CCCS-12.1.3.1	Action Step	Agriculture	Establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.	2	10	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-12.1.3.2	Action Step	Agriculture	Reduce the encroachment of agricultural activities in areas within 100 feet of the stream bank	2	10	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-12.1.3.3	Action Step	Agriculture	Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land activities.	2	20	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-12.1.3.4	Action Step	Agriculture	Re-establish native plant communities in riparian zones with a goal of increasing stream canopy to 80%	2	10	NRCS, Private Landowners, RCD	
GIC-CCCS-12.1.4	Recovery Action	Agriculture	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
GIC-CCCS-12.1.4.1	Action Step	Agriculture	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	2	20	NRCS, RCD	
GIC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
GIC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure				
GIC-CCCS-12.2.1.1	Action Step	Agriculture	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2	5	Sonoma County	
GIC-CCCS-12.2.1.2	Action Step	Agriculture	Enforce requirements of local regulations and riparian/setbacks	2	10	CDFW, Sonoma County	
GIC-CCCS-12.2.1.3	Action Step	Agriculture	Work with regulatory agencies and landowners to discourage marijuana cultivation and/or control riparian removal, water use and toxic inputs known to have adverse affects to CCC steelhead stream habitats.	2	5	CDFW Law Enforcement, NCRWQB, NMFS OLE, SWRCB	
GIC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GIC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				

Gill Greek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GIC-CCCS-13.1.1.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	20	Corps, Private Landowners, RCD, Sonoma County	
GIC-CCCS-13.1.1.2	Action Step	Channel Modification	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	3	10	Private Landowners, RCD, Sonoma County	
GIC-CCCS-13.1.1.3	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris, riparian plantings, bank setbacks, or other methodologies to minimize habitat alteration effects.	2	20	CDFW, Corps, Private Landowners, RCD	
GIC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to passage and migration				
GIC-CCCS-13.1.2.1	Action Step	Channel Modification	Remove remnants of the old River Road crossing (just downstream of current crossing) to improve fish passage in lower Gill Creek	2	5	CDFW, NOAA RC, Sonoma County	
GIC-CCCS-13.1.2.2	Action Step	Channel Modification	Ensure all future bank stabilization projects minimize rip-rap, thoroughly evaluate all alternatives to rip-rap, and at minimum incorporate fish habitat complexity features.	3	20	CDFW, Corps, NMFS, Private Landowners, RCD	
GIC-CCCS-13.1.2.3	Action Step	Channel Modification	Incorporate velocity refuge habitat features in all future and existing engineered and modified channels.	2	20	Corps, RCD	
GIC-CCCS-13.1.3	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
GIC-CCCS-13.1.3.1	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	2	10	CDFW, NMFS, Private Landowners, RCD	
GIC-CCCS-13.1.3.2	Action Step	Channel Modification	Projects should seek alternatives to bank hardening and promote bioengineering solutions where feasible.	2	10	CDFW, Private Landowners, RCD	
GIC-CCCS-13.1.3.3	Action Step	Channel Modification	Identify areas within modified channels where habitat features can be installed that provided shelter and velocity refuge for migrating steelhead.	2	5	CDFW, NMFS, Private Landowners, RCD	
GIC-CCCS-13.1.4	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GIC-CCCS-13.1.4.1	Action Step	Channel Modification	Develop Bank Stabilization Guidelines for private and public entities targeting fine sediment reduction in efforts to improve instream gravel quality.	3	5	CDFW, Five Counties Salmonid Conservation Program, NMFS, RCD	
GIC-CCCS-13.1.5	Recovery Action	Channel Modification	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool:riffle ratios)				
GIC-CCCS-13.1.5.1	Action Step	Channel Modification	Design channel modifying projects to fully minimize and mitigate effects and, where possible, remedy existing poor conditions.	2	10	NOAA RC, Private Landowners, RCD	
GIC-CCCS-13.1.5.2	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	2	20	NRCS, RCD, Sonoma County	
GIC-CCCS-13.1.5.3	Action Step	Channel Modification	Minimize any future channel modification in potentially high value seasonal habitat and migration (staging) areas.	2	20	CDFW, Corps, NMFS	
GIC-CCCS-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GIC-CCCS-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)				
GIC-CCCS-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	CDFW, NCRWQB, NRCS, RCD, Private Landowners	
GIC-CCCS-18.1.1.2	Action Step	Livestock	Relocate instream livestock watering sources	2	10	NRCS, RCD, Private Landowners	
GIC-CCCS-18.1.1.3	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	10	NCRWQB, NRCS, RCD, Private Landowners	
GIC-CCCS-18.1.2	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GIC-CCCS-18.1.2.1	Action Step	Livestock	Assess grazing impact on riparian condition, identifying opportunities for improvement.	3	50	NCRWQB, NRCS, RCD, Sonoma County, Private Landowners	
GIC-CCCS-18.1.2.2	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	5	CDFW, NOAA RC, NRCS, RCD	
GIC-CCCS-18.1.2.3	Action Step	Livestock	Exclude cattle from entering and trampling steelhead spawning and rearing habitat.	2	5	CDFW, NRCS, RCD, Private Landowners	
GIC-CCCS-22.1	**Objective**	**Residential /Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Gill Greek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GIC-CCCS-22.1.1	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
GIC-CCCS-22.1.1.1	Action Step	Residential /Commercial Development	Add large woody debris to reach optimal frequencies	2	5	CDFW, NOAA RC, NRCS, RCD	
GIC-CCCS-22.1.1.2	Action Step	Residential /Commercial Development	Avoid the removal of large wood and other shelter components from the stream system	2	20	NRCS, Private Landowners, RCD	
GIC-CCCS-22.1.1.3	Action Step	Residential /Commercial Development	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	10	NRCS, RCD	
GIC-CCCS-22.1.1.4	Action Step	Residential /Commercial Development	Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors.	2	20	NRCS, Private Landowners, RCD	
GIC-CCCS-22.1.2	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GIC-CCCS-22.1.2.1	Action Step	Residential /Commercial Development	Maintain adequate stream corridor buffers to filter and prevent fine sediment input from entering Miller Creek	2	10	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-22.1.2.2	Action Step	Residential /Commercial Development	Minimize development within riparian zones and the 100-year floodprone zones.	2	10	Private Landowners, Sonoma County	
GIC-CCCS-22.1.2.3	Action Step	Residential /Commercial Development	Minimize new construction in undeveloped areas within the 100-year flood prone zones in all historical CCC steelhead watersheds.	2	5	Sonoma County	
GIC-CCCS-22.1.3	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure				
GIC-CCCS-22.1.3.1	Action Step	Residential /Commercial Development	Establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.	2	10	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-22.1.3.2	Action Step	Residential /Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	10	Private Landowners, RCD, Sonoma County	
GIC-CCCS-22.1.3.3	Action Step	Residential /Commercial Development	Re-establish native plant communities in riparian zones with a goal of increasing stream canopy to 80%	2	10	NOAA RC, NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-22.1.4	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GIC-CCCS-22.1.4.1	Action Step	Residential /Commercial Development	Expand incentive programs for rain collection systems.	2	10	NMFS, SWRCB	
GIC-CCCS-22.1.4.2	Action Step	Residential /Commercial Development	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	2	10	RCD	
GIC-CCCS-22.1.4.3	Action Step	Residential /Commercial Development	See WATER DIVERSIONS for specific actions and areas				
GIC-CCCS-22.1.5	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to instream habitat complexity (altered pool frequency and/or pool riffle ratio)				
GIC-CCCS-22.1.5.1	Action Step	Residential /Commercial Development	Design channel modification projects to fully minimize and mitigate effects and, where possible, remedy poor conditions	2	5	NOAA RC, Private Landowners, RCD	
GIC-CCCS-22.1.5.2	Action Step	Residential /Commercial Development	Encourage retention and recruitment of Large Woody Debris to rehabilitate existing stream complexity, pool frequency, and depth	2	10	CDFW, NMFS, RCD, Sonoma County	
GIC-CCCS-22.1.5.3	Action Step	Residential /Commercial Development	Minimize any future channel modification in potentially high value seasonal habitat	2	10	CDFW, Corps, NMFS, Sonoma County	

Gill Greek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GIC-CCCS-22.2	**Objective**	**Residential /Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**				
GIC-CCCS-22.2.1	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure				
GIC-CCCS-22.2.1.1	Action Step	Residential /Commercial Development	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2	5	Sonoma County	
GIC-CCCS-22.2.1.2	Action Step	Residential /Commercial Development	Enforce requirements of local regulations and riparian/setbacks	2	5	Sonoma County	
GIC-CCCS-22.2.1.3	Action Step	Residential /Commercial Development	Increase monitoring and enforcement of illegal bank or shoreline stabilization activities.	2	10	CDFW, Corps, Sonoma County	
GIC-CCCS-22.2.2	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GIC-CCCS-22.2.2.1	Action Step	Residential /Commercial Development	Encourage the State Division of Water Rights to evaluate water rights compliance in all sub-watersheds where new development is proposed.	3	5	CDFW, NMFS, Trout Unlimited	
GIC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
GIC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GIC-CCCS-23.1.1.1	Action Step	Roads/Railroads	All bridges associated with new roads and railroads or replacement bridges should be free span or constructed with the minimal amount of impairment to the stream channel.	2	10	NOAA RC, NRCS, Sonoma County	
GIC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CDFW, NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Minimize placing new roadways within riparian zones.	3	100	NCRWQB, Private Landowners, Sonoma County	
GIC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Conduct actions that hydrologically disconnect roads, particular attention to addressing sedimentation at road crossing the mainstem just upstream of the mouth of South Fork Gill Creek.	2	10	NRCS, RCD, Sonoma County	
GIC-CCCS-23.1.1.5	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	3	100	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-23.1.1.6	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	2	10	NRCS, RCD, Sonoma County	
GIC-CCCS-23.1.1.7	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority riparian roads (including private roads or driveways), or those identified in a sediment reduction plan.	2	10	NRCS, RCD, Sonoma County	
GIC-CCCS-23.1.1.8	Action Step	Roads/Railroads	Minimize new road construction within the watershed in general, and within 200 meters of the riparian corridor in particular. Limit construction of new road crossings.	2	20	NRCS, Private Landowners, RCD, Sonoma County	
GIC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
GIC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
GIC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Continue education of County road engineers and maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	2	20	NMFS, NRCS, Sonoma County	
GIC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	2	5	Sonoma County	
GIC-CCCS-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Gill Greek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
GIC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GIC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Adequately screen water diversions to prevent entrainment of all steelhead life stages.	2	5	CDFW, NMFS, NRCS, RCD, SWRCB	
GIC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	Assess and map water diversions (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
GIC-CCCS-25.1.1.3	Action Step	Water Diversion /Impoundment	Minimize new or increased summer diversions.	2	20	Private Landowners, Sonoma County, SWRCB	
GIC-CCCS-25.1.1.4	Action Step	Water Diversion /Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	2	5	CDFW, NMFS, NRCS, RCD	
GIC-CCCS-25.1.1.5	Action Step	Water Diversion /Impoundment	Coordinate timing of water diversions to minimize the likelihood of fish stranding and stream dewatering.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
GIC-CCCS-25.1.1.6	Action Step	Water Diversion /Impoundment	Develop strategies to reduce impacts of well pumping on summer and fall instream water temperatures and baseflows.	2	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
GIC-CCCS-25.1.1.7	Action Step	Water Diversion /Impoundment	Work with partners to ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer or fall rearing reaches.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD, SWRCB	
GIC-CCCS-25.1.1.8	Action Step	Water Diversion /Impoundment	Evaluate the feasibility and potential benefit of consolidating diversions to a centralized location lower in the watershed.	2	5	CDFW, NRCS, RCD	
GIC-CCCS-25.1.1.9	Action Step	Water Diversion /Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	5	RCD	
GIC-CCCS-25.1.1.10	Action Step	Water Diversion /Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	5	CDFW, NMFS, NRCS, RCD	
GIC-CCCS-25.1.1.11	Action Step	Water Diversion /Impoundment	Promote irrigation efficiency projects for agricultural uses in the watershed.	2	10	NRCS, Private Landowners, RCD	
GIC-CCCS-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
GIC-CCCS-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
GIC-CCCS-25.2.1.1	Action Step	Water Diversion /Impoundment	Evaluate and monitor streambed alteration program compliance related to all water diversions (CDFG 2004).	2	10	CDFW, SWRCB	
GIC-CCCS-25.2.1.2	Action Step	Water Diversion /Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, SWRCB	
GIC-CCCS-25.2.1.3	Action Step	Water Diversion /Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	5	CDFW, NMFS, Sonoma County, Trout Unlimited	
GIC-CCCS-25.2.1.4	Action Step	Water Diversion /Impoundment	Support the development and implementation of groundwater use regulations.	2	10	CDFW, NMFS, Sonoma County, SWRCB, The Nature Conservancy, Trout Unlimited	

Miller Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MlrC-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MlrC-CCCS-10.1.1	Recovery Action	Water Quality	Improve stream water quality conditions				
MlrC-CCCS-10.1.1.1	Action Step	Water Quality	Evaluate water quality below likely sources of contamination.	2	5	NCRWQB, NRCS, RCD	
MlrC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MlrC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
MlrC-CCCS-12.1.1.1	Action Step	Agriculture	Add large woody debris to reach optimal frequencies	2	5	NRCS, Private Landowners, RCD	
MlrC-CCCS-12.1.1.2	Action Step	Agriculture	Avoid the removal of large wood and other shelter components from the stream system	2	20	Private Landowners	
MlrC-CCCS-12.1.1.3	Action Step	Agriculture	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	5	CDFW, NMFS, NRCS, RCD	
MlrC-CCCS-12.1.1.4	Action Step	Agriculture	Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors.	2	20	NRCS, Private Landowners, RCD	
MlrC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
MlrC-CCCS-12.1.2.1	Action Step	Agriculture	Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to reduce sediment sources and improve riparian habitat within the watershed.	2	20	Farm Bureau, NRCS, Private Landowners, RCD	
MlrC-CCCS-12.1.2.2	Action Step	Agriculture	Promote agricultural practices that protect and restore CCC steelhead habitat by working with the agricultural community.	3	100	Farm Bureau, NRCS, RCD	
MlrC-CCCS-12.1.2.3	Action Step	Agriculture	Work with vineyard owners to assess the effectiveness of erosion control measures throughout the winter period.	2	5	NRCS, RCD, Sonoma County	
MlrC-CCCS-12.1.2.4	Action Step	Agriculture	Maintain adequate stream corridor buffers to filter and prevent fine sediment input from entering the creek	2	20	NRCS, Private Landowners, RCD	
MlrC-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure				
MlrC-CCCS-12.1.3.1	Action Step	Agriculture	Establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.	2	10	NRCS, Private Landowners, RCD, Sonoma County	
MlrC-CCCS-12.1.3.2	Action Step	Agriculture	Reduce the encroachment of agricultural activities in areas within 100 feet of the stream bank	2	10	NRCS, Private Landowners, RCD, Sonoma County	
MlrC-CCCS-12.1.3.3	Action Step	Agriculture	Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land activities.	2	20	NRCS, Private Landowners, RCD, Sonoma County	
MlrC-CCCS-12.1.3.4	Action Step	Agriculture	Re-establish native plant communities in riparian zones with a goal of increasing stream canopy to 80%	2	10	NRCS, Private Landowners, RCD	
MlrC-CCCS-12.1.4	Recovery Action	Agriculture	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
MlrC-CCCS-12.1.4.1	Action Step	Agriculture	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	2	20	NRCS, RCD	
MlrC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
MlrC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure				
MlrC-CCCS-12.2.1.1	Action Step	Agriculture	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do.	2	5	Sonoma County	
MlrC-CCCS-12.2.1.2	Action Step	Agriculture	Enforce requirements of local regulations and riparian/setbacks	2	10	CDFW, Sonoma County	
MlrC-CCCS-12.2.1.3	Action Step	Agriculture	Work with regulatory agencies and landowners to discourage marijuana cultivation and/or control riparian removal, water use and toxic inputs known to have adverse affects to steelhead stream habitats.	2	5	CDFW Law Enforcement, NCRWQB, NMFS OLE	
MlrC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MlrC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
MlrC-CCCS-13.1.1.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	20	Corps, Private Landowners, RCD, Sonoma County	

Miller Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MlrC-CCCS-13.1.1.2	Action Step	Channel Modification	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	3	10	Private Landowners, RCD, Sonoma County	
MlrC-CCCS-13.1.1.3	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris, riparian plantings, bank setbacks, or other methodologies to minimize habitat alteration effects.	2	20	CDFW, Corps, Private Landowners, RCD	
MlrC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to passage and migration				
MlrC-CCCS-13.1.2.1	Action Step	Channel Modification	Ensure all future bank stabilization projects minimize rip-rap, thoroughly evaluate all alternatives to rip-rap, and at minimum incorporate fish habitat complexity features.	3	20	CDFW, Corps, NMFS, Private Landowners, RCD	
MlrC-CCCS-13.1.2.2	Action Step	Channel Modification	Conduct rehabilitation activities that restore channels and floodplains to extend the duration of spring and summer stream flows.	3	10	Corps, NMFS, Private Landowners, RCD, Sonoma County	
MlrC-CCCS-13.1.2.3	Action Step	Channel Modification	Incorporate velocity refuge habitat features in all future and existing engineered and modified channels.	2	20	Corps, RCD	
MlrC-CCCS-13.1.3	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
MlrC-CCCS-13.1.3.1	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	2	10	CDFW, NMFS, Private Landowners, RCD	
MlrC-CCCS-13.1.3.2	Action Step	Channel Modification	Projects should seek alternatives to bank hardening and promote bioengineering solutions where feasible.	2	10	CDFW, Private Landowners, RCD	
MlrC-CCCS-13.1.3.3	Action Step	Channel Modification	Develop and implement stream maintenance plans that minimize impacts to salmonid habitat complexity features (LWD, root wads, boulders) in modified and engineered channels.	2	10	Sonoma County	
MlrC-CCCS-13.1.3.4	Action Step	Channel Modification	Identify areas within modified channels where habitat features can be installed that provided shelter and velocity refuge for migrating steelhead.	2	5	CDFW, NMFS, Private Landowners, RCD	
MlrC-CCCS-13.1.4	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
MlrC-CCCS-13.1.4.1	Action Step	Channel Modification	Develop Bank Stabilization Guidelines for private and public entities targeting fine sediment reduction in efforts to improve instream gravel quality.	3	5	CDFW, Five Counties Salmonid Conservation Program, NMFS, RCD	
MlrC-CCCS-13.1.5	Recovery Action	Channel Modification	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool: riffle ratios)				
MlrC-CCCS-13.1.5.1	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	3	100	CDFW, Sonoma County, NMFS, RCD	
MlrC-CCCS-13.1.5.2	Action Step	Channel Modification	Minimize any future channel modification in potentially high value seasonal habitat and migration (staging) areas.	3	100	CDFW, Sonoma County, NMFS, RCD	
MlrC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MlrC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
MlrC-CCCS-23.1.1.1	Action Step	Roads/Railroads	All bridges associated with new roads and railroads or replacement bridges should be free span or constructed with the minimal amount of impairment to the stream channel.	2	10	NOAA RC, NRCS, Sonoma County	
MlrC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CDFW, NRCS, Private Landowners, RCD, Sonoma County	
MlrC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Minimize placing new roadways within riparian zones.	3	100	NCRWQB, Private Landowners, Sonoma County	
MlrC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	3	100	NRCS, Private Landowners, RCD, Sonoma County	
MlrC-CCCS-23.1.1.5	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	2	10	NRCS, RCD, Sonoma County	
MlrC-CCCS-23.1.1.6	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority riparian roads (including private roads or driveways), or those identified in a sediment reduction plan.	2	10	NRCS, RCD, Sonoma County	
MlrC-CCCS-23.1.1.7	Action Step	Roads/Railroads	Minimize new road construction within the watershed in general, and within 200 meters of the riparian corridor in particular. Limit construction of new road crossings.	2	20	NRCS, Private Landowners, RCD, Sonoma County	

Miller Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MlrC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
MlrC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
MlrC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Continue education of County road engineers and maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	2	20	NMFS, NRCS, Sonoma County	
MlrC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	2	5	Sonoma County	
MlrC-CCCS-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
MlrC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MlrC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent entrainment of all steelhead life stages.	2	5	CDFW, NMFS, NRCS, RCD, SWRCB	
MlrC-CCCS-25.1.1.2	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
MlrC-CCCS-25.1.1.3	Action Step	Water Diversion/ Impoundment	Minimize new or increased summer diversions.	2	20	Private Landowners, Sonoma County, SWRCB	
MlrC-CCCS-25.1.1.4	Action Step	Water Diversion/ Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	2	5	CDFW, NMFS, NRCS, RCD	
MlrC-CCCS-25.1.1.5	Action Step	Water Diversion/ Impoundment	Coordinate timing of water diversions to minimize the likelihood of fish stranding and stream dewatering.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
MlrC-CCCS-25.1.1.6	Action Step	Water Diversion/ Impoundment	Develop strategies to reduce impacts of well pumping on summer and fall instream water temperatures and baseflows.	2	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
MlrC-CCCS-25.1.1.7	Action Step	Water Diversion/ Impoundment	Work with partners to ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer or fall rearing reaches.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD, SWRCB	
MlrC-CCCS-25.1.1.8	Action Step	Water Diversion/ Impoundment	Evaluate the feasibility and potential benefit of consolidating diversions to a centralized location lower in the watershed.	2	5	CDFW, NRCS, RCD	
MlrC-CCCS-25.1.1.9	Action Step	Water Diversion/ Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	5	Sonoma County Water Agency	
MlrC-CCCS-25.1.1.10	Action Step	Water Diversion/ Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	5	CDFW, NMFS, NRCS, RCD	
MlrC-CCCS-25.1.1.11	Action Step	Water Diversion/ Impoundment	Promote irrigation efficiency projects for agricultural uses in the watershed.	2	10	NRCS, Private Landowners, RCD	
MlrC-CCCS-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
MlrC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
MlrC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Evaluate and monitor streambed alteration program compliance related to all water diversions (CDFG 2004).	2	10	CDFW	
MlrC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Implement forbearance program.	2	5	SWRCB	

Miller Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
MlrC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, SWRCB	
MlrC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	5	CDFW, NMFS, Sonoma County, Trout Unlimited	
MlrC-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Support the development and implementation of groundwater use regulations.	2	10	CDFW, NMFS, Sonoma County, Sonoma County Water Agency, SWRCB, The Nature Conservancy, Trout Unlimited	

Sausal Creek, Central California Coast Steelhead (Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SaC-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SaC-CCCS-10.1.1	Recovery Action	Water Quality	Improve stream water quality conditions				
SaC-CCCS-10.1.1.1	Action Step	Water Quality	Evaluate water quality below likely sources of contamination.	2	5	NCRWQB, NRCS, RCD	
SaC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SaC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
SaC-CCCS-12.1.1.1	Action Step	Agriculture	Collaborate with landowners and Resource Conservation District on survey of stream's pool frequency, pool shelter, stream substrate embeddedness and riparian vegetation structure	2	5	CDFW, NMFS	
SaC-CCCS-12.1.1.2	Action Step	Agriculture	Avoid the removal of large wood and other shelter components from the stream system	2	20	Private Landowners	
SaC-CCCS-12.1.1.3	Action Step	Agriculture	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	5	CDFW, NMFS, NRCS, RCD	
SaC-CCCS-12.1.1.4	Action Step	Agriculture	Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors.	2	20	NRCS, Private Landowners, RCD	
SaC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
SaC-CCCS-12.1.2.1	Action Step	Agriculture	Maintain adequate stream corridor buffers to filter and prevent fine sediment input from entering the creek	2	20	NRCS, Private Landowners, RCD	
SaC-CCCS-12.1.2.2	Action Step	Agriculture	Promote agricultural practices that protect and restore CCC steelhead habitat by working with the agricultural community.	2	20	Farm Bureau, NRCS, RCD	
SaC-CCCS-12.1.2.3	Action Step	Agriculture	Work with vineyard owners to assess the effectiveness of erosion control measures throughout the winter period.	2	5	NRCS, RCD, Sonoma County	
SaC-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure				
SaC-CCCS-12.1.3.1	Action Step	Agriculture	Reduce the encroachment of agricultural activities in areas within 100 feet of the stream bank	2	10	NRCS, Private Landowners, RCD, Sonoma County	
SaC-CCCS-12.1.3.2	Action Step	Agriculture	Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land activities.	2	20	NRCS, Private Landowners, RCD, Sonoma County	
SaC-CCCS-12.1.3.3	Action Step	Agriculture	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	20	NRCS, Private Landowners, RCD	
SaC-CCCS-12.1.3.4	Action Step	Agriculture	Re-establish native plant communities in riparian zones with a goal of increasing stream canopy to 80%	2	10	NRCS, Private Landowners, RCD	
SaC-CCCS-12.1.4	Recovery Action	Agriculture	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
SaC-CCCS-12.1.4.1	Action Step	Agriculture	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	2	20	NRCS, RCD	
SaC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacy of existing regulatory mechanisms**				
SaC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure				
SaC-CCCS-12.2.1.1	Action Step	Agriculture	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2	5	Sonoma County	
SaC-CCCS-12.2.1.2	Action Step	Agriculture	Enforce requirements of local regulations and riparian/setbacks	2	10	CDFW, Sonoma County	
SaC-CCCS-12.2.1.3	Action Step	Agriculture	Work with regulatory agencies and landowners to discourage marijuana cultivation and/or control riparian removal, water use and toxic inputs known to have adverse affects to steelhead stream habitats.	2	5	CDFW Law Enforcement, NCRWQB, NMFS OLE	
SaC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SaC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
SaC-CCCS-13.1.1.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	20	Corps, Private Landowners, RCD, Sonoma County	
SaC-CCCS-13.1.1.2	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris, riparian plantings, bank setbacks, or other methodologies to minimize habitat alteration effects.	2	20	CDFW, Corps, Private Landowners, RCD	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SaC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool: riffle ratios)				
SaC-CCCS-13.1.2.1	Action Step	Channel Modification	Collaborate with landowners and Resource Conservation District in survey of stream's pool frequency, pool shelter, substrate embeddedness, and riparian vegetation composition and structure	2	5	CDFW, NMFS	
SaC-CCCS-13.1.2.2	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	2	20	NRCS, RCD, Sonoma County	
SaC-CCCS-13.1.2.3	Action Step	Channel Modification	Minimize any future channel modification in potentially high value seasonal habitat and migration (staging) areas.	2	20	CDFW, Corps, NMFS	
SaC-CCCS-13.1.3	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
SaC-CCCS-13.1.3.1	Action Step	Channel Modification	Encourage retention and recruitment of large woody debris to rehabilitate existing stream complexity, pool frequency, and depth.	2	10	CDFW, NMFS, Private Landowners, RCD	
SaC-CCCS-13.1.3.2	Action Step	Channel Modification	Stream modification projects should seek alternatives to bank hardening and promote bioengineering solutions where feasible.	2	10	CDFW, Corps, Private Landowners, RCD	
SaC-CCCS-13.1.3.3	Action Step	Channel Modification	Develop and implement stream maintenance plans that minimize impacts to salmonid habitat complexity features (LWD, root wads, boulders) in modified and engineered channels.	2	5	Sonoma County	
SaC-CCCS-13.1.3.4	Action Step	Channel Modification	Identify areas within modified channels where habitat features can be installed that provide shelter and velocity refuge for migrating steelhead.	2	5	CDFW, NMFS, Private Landowners, RCD	
SaC-CCCS-13.1.4	Recovery Action	Channel Modification	Prevent or minimize impairment to passage and migration				
SaC-CCCS-13.1.4.1	Action Step	Channel Modification	Ensure all future bank stabilization projects minimize rip-rap, thoroughly evaluate all alternatives to rip-rap, and at minimum incorporate fish habitat complexity features.	3	20	CDFW, Corps, NMFS, Private Landowners, RCD	
SaC-CCCS-13.1.4.2	Action Step	Channel Modification	Incorporate velocity refuge habitat features in all future and existing engineered and modified channels.	2	20	Corps, RCD	
SaC-CCCS-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SaC-CCCS-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream habitat complexity (altered pool complexity and/or pool: riffle ratio)				
SaC-CCCS-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	CDFW, NCRWQB, NRCS, RCD	
SaC-CCCS-18.1.1.2	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	10	NCRWQB, NRCS, RCD	
SaC-CCCS-18.1.2	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
SaC-CCCS-18.1.2.1	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	5	CDFW, NOAA RC, NRCS, RCD	
SaC-CCCS-18.1.2.2	Action Step	Livestock	Fence livestock out of riparian zones.	2	5	CDFW, NRCS, RCD	
SaC-CCCS-18.1.2.3	Action Step	Livestock	Relocate instream livestock watering sources	2	5	NRCS, RCD	
SaC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SaC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
SaC-CCCS-23.1.1.1	Action Step	Roads/Railroads	All bridges associated with new roads and railroads or replacement bridges should be free span or constructed with the minimal amount of impairment to the stream channel.	2	10	NOAA RC, NRCS, Sonoma County	
SaC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10	CDFW, NRCS, Private Landowners, RCD, Sonoma County	
SaC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Minimize placing new roadways within riparian zones.	2	20	NCRWQB, Private Landowners, Sonoma County	
SaC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	3	25	NRCS, Private Landowners, RCD, Sonoma County	
SaC-CCCS-23.1.1.5	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	2	10	NRCS, RCD, Sonoma County	
SaC-CCCS-23.1.1.6	Action Step	Roads/Railroads	Replace problematic culverts and low flow crossings in Class 1 streams with bridges or appropriate cost effective designs.	2	10	CDFW, NOAA RC, NRCS, Private Landowners, RCD	

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SaC-CCCS-23.1.1.7	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority riparian roads (including private roads or driveways), or those identified in a sediment reduction plan.	2	10	NRCS, RCD, Sonoma County	
SaC-CCCS-23.1.1.8	Action Step	Roads/Railroads	Minimize new road construction within the watershed in general, and within 200 meters of the riparian corridor in particular. Limit construction of new road crossings.	2	20	NRCS, Private Landowners, RCD, Sonoma County	
SaC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
SaC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
SaC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Continue education of County road engineers and maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	2	20	NMFS, NRCS, Sonoma County	
SaC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to steelhead.	2	5	Sonoma County	
SaC-CCCS-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
SaC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SaC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent entrainment of all steelhead life stages.	2	5	CDFW, NMFS, NRCS, Private Landowners, RCD, SWRCB	
SaC-CCCS-25.1.1.2	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	2	10	CDFW, NMFS, SWRCB	
SaC-CCCS-25.1.1.3	Action Step	Water Diversion/ Impoundment	Minimize new or increased summer diversions.	2	20	Private Landowners, Sonoma County, SWRCB	
SaC-CCCS-25.1.1.4	Action Step	Water Diversion/ Impoundment	Collaborate with landowners to minimize impacts on summer base flow from riparian water diversion activities.	2	5	CDFW, NMFS, NRCS, RCD	
SaC-CCCS-25.1.1.5	Action Step	Water Diversion/ Impoundment	Coordinate timing of water diversions to minimize the likelihood of fish stranding and stream dewatering.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD	
SaC-CCCS-25.1.1.6	Action Step	Water Diversion/ Impoundment	Develop strategies to reduce impacts of well pumping on summer and fall instream water temperatures and baseflows.	2	5	CDFW, NMFS, NRCS, Private Landowners, RCD	
SaC-CCCS-25.1.1.7	Action Step	Water Diversion/ Impoundment	Work with partners to ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer or fall rearing reaches.	2	10	CDFW, NMFS, NRCS, Private Landowners, RCD, SWRCB	
SaC-CCCS-25.1.1.8	Action Step	Water Diversion/ Impoundment	Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow	2	5	CDFW, NMFS, NRCS, RCD, SWRCB	
SaC-CCCS-25.1.1.9	Action Step	Water Diversion/ Impoundment	Evaluate the feasibility and potential benefit of consolidating diversions to a centralized location lower in the watershed.	2	5	CDFW, NRCS, RCD	
SaC-CCCS-25.1.1.10	Action Step	Water Diversion/ Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	5	Sonoma County Water Agency	
SaC-CCCS-25.1.1.11	Action Step	Water Diversion/ Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	5	CDFW, NMFS, NRCS, RCD	
SaC-CCCS-25.1.1.12	Action Step	Water Diversion/ Impoundment	Promote irrigation efficiency projects for agricultural uses in the watershed.	2	10	NRCS, Private Landowners, RCD	
SaC-CCCS-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
SaC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
SaC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Evaluate and monitor streambed alteration program compliance related to all water diversions (CDFG 2004).	2	10	CDFW	
SaC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, SWRCB	
SaC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	5	CDFW, NMFS, Sonoma County, Sonoma County Water Agency, Trout Unlimited	
SaC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Support the development and implementation of groundwater use regulations.	2	10	CDFW, NMFS, Sonoma County, Sonoma County Water Agency, SWRCB, The Nature Conservancy, Trout Unlimited	