Santa Cruz Mountains Diversity Stratum

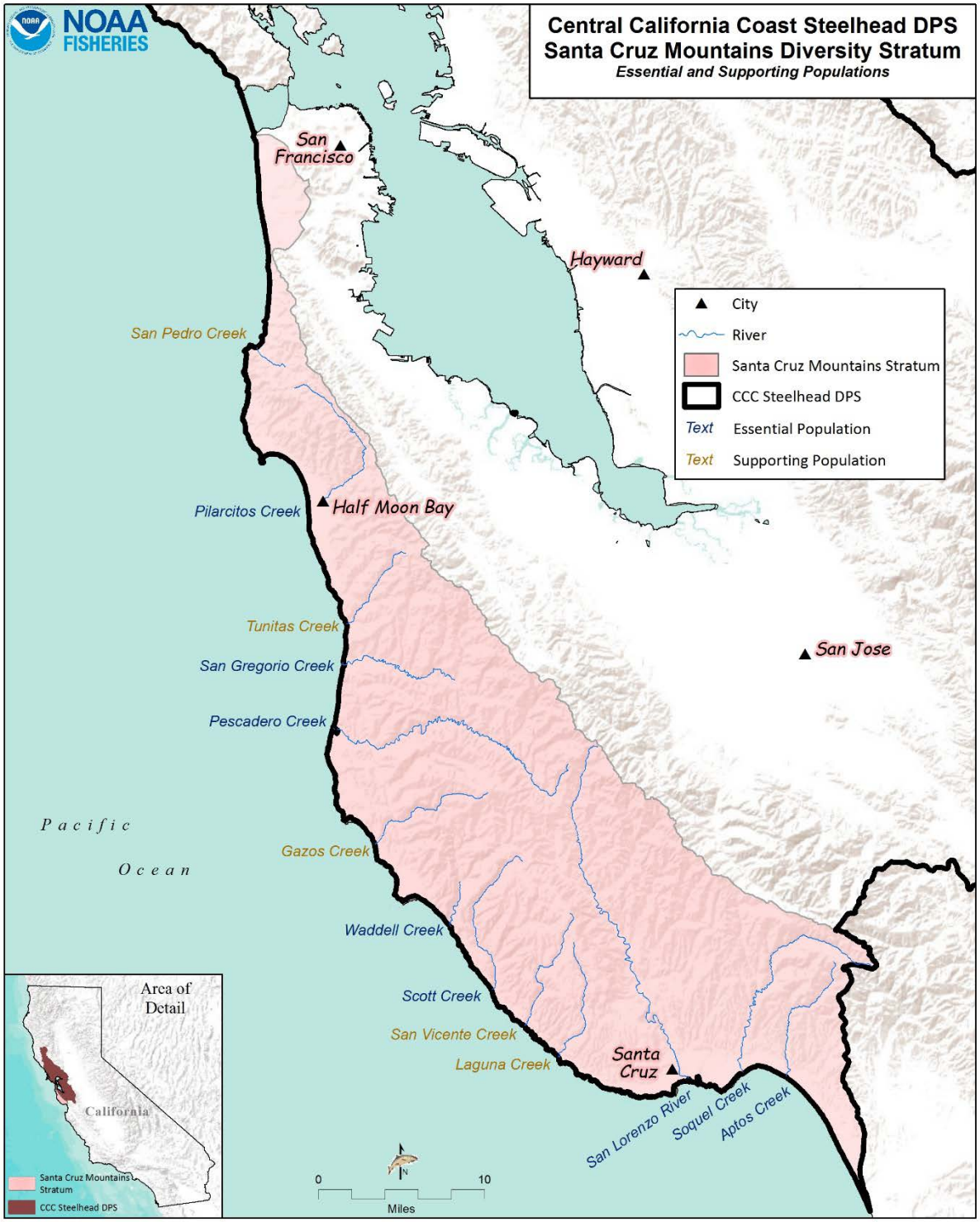
This stratum includes populations of steelhead that spawn in watersheds that drain the Santa Cruz Mountains and are direct tributaries to the Pacific Ocean.

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 Assessments of the Supporting populations:

- Aptos Creek
- Pescadero Creek
- Pilarcitos Creek
- San Gregorio Creek
- San Lorenzo River
- Scott Creek
- Soquel Creek
- Waddell Creek
- Santa Cruz Mountains Diversity Stratum Rapid Assessment
    - Gazos Creek
    - Laguna Creek
    - San Pedro Creek
    - San Vicente Creek
    - Tunitas Creek

CCC steelhead Santa Cruz Mountains Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting. *IP was not developed for these populations by the SWFSC.

Diversity Stratum	CCC Steelhead Population	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
Santa Cruz Mountains	Aptos Creek	I	Essential	25.1	38.7	1,000
	Gazos Creek	D	Supporting	12.5	6-12	73-148
	Laguna Creek	I	Supporting	4.5	6-12	25-52
	Pescadero Creek	I	Essential	66.1	33.0	2,200
	Pilarcitos Creek	I	Essential	28.5	38.3	1,100
	San Gregorio Creek	I	Essential	46.6	35.7	1,700
	San Lorenzo River	I	Essential	146.2	21.9	3,200
	San Pedro Creek*	D	Supporting	N/A	N/A	N/A
	San Vicente Creek	D	Supporting	5.7	6-12	32-66
	Scott Creek	I	Essential	16.4	39.9	700
	Soquel Creek	I	Essential	52.0	35	1,800
	Tunitas Creek	D	Supporting	10.7	6-12	62-126
	Waddell Creek	I	Essential	10.8	40	500
Santa Cruz Mountains Diversity Stratum Recovery Target						12,200



CCC steelhead Santa Cruz Mountains Diversity Stratum

Aptos Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 1,000 adults
- Current Intrinsic Potential: 25.1 IP-km

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

Steelhead Abundance and Distribution

Mainstem Aptos Creek is about 9.4 miles long and drains a watershed of approximately 25 square miles. A major tributary, Valencia Creek, is about 7.2 stream miles and drains a watershed of about 12 square miles. Aptos Creek has long been recognized as an important steelhead spawning and nursery stream and it is the southern-most watershed in the steelhead DPS. Aptos Creek flows into the Aptos Creek lagoon before flowing into Monterey Bay.

In 1968, the adult steelhead run in Aptos Creek was estimated by CDFW at about 1,500 fish (although the method used to attain this estimate was not described (Titus *et al*. 2010)). A 1960 stream survey estimated the density of steelhead/rainbow trout at up to 65 per 100 feet in the upper portion of the watershed and a density of 40-50 per 100 feet for much of the lower section to the mouth. A 1965 survey estimated there were eight miles of nursery area with the average number of rearing steelhead/rainbow trout estimated at 100 per 100 feet; one half-mile section had an estimated density of 140 trout per 100 feet of stream (Hagar Environmental Science 2003). In 2011-12, a total of 5 steelhead redds (2.61 redds per kilometer) were observed in 1.92 kilometers of Aptos Creek (Jankovitz 2012). In 2012-13, CDFW surveyed 4.73 kilometers in three reaches of the Aptos Creek watershed (2 mainstem, 1 Bridge Creek). A total of 22 steelhead redds (4.65 redds per kilometer) and five steelhead adults were observed (Jankovitz 2013).

Fish sampling and habitat assessments were conducted in both Aptos and Valencia Creeks in 1981 (Hagar Environmental Science 2003). Rearing densities of smolt-sized steelhead ranged from 1 fish per 100 feet (Aptos Creek below Valencia Creek) to 24 fish per 100 feet (Aptos Creek in Nisene Marks State Park; Hagar Environmental Science 2003). CDFW conducted sampling in Aptos Creek in 1996 and found densities of 1+ and older trout between 1.8 and 25.8 per 100 feet in pool habitats (Hagar Environmental Science 2003).

At two sites in Aptos Creek, (one in lower Aptos Creek above the Valencia Creek confluence and the other in Nisene Marks State Park) YOY steelhead densities averaged 29.8 and 34.1, respectively, per 100 feet in 2006-2009 (D.W. Alley & Associates 2010). At two sites in Valencia Creek (above East Branch), YOY steelhead densities averaged 20.8 and 18.2, respectively, per 100 feet in 2006-2009 (D.W. Alley & Associates 2010). Smolt-sized densities, during the same period at the same locations, were 10.4 and 9.5 per 100 feet, in Aptos Creek and 12.3 and 13.9 per 100 feet, in Valencia Creek (D.W. Alley & Associates 2010). In 2010, on lower Valencia Creek, 30 juvenile steelhead were captured in one pool and relocated during construction activities (D. Alley unpublished data, 2010).

History of Land Use

In the 1850s, early settlers in the area began entering the watershed to cut oak firewood and make shakes and lumber out of the redwood trees closest to the coast. The steep, narrow canyons continued to protect the upper areas of the watershed until the early 1880s. Railroad workers cut and graded the steep hillsides to lay seven miles of railroad track into the canyon. Logging was the dominant land use in the basin; between 1883 and 1923, 150 million board feet of lumber was extracted from the Aptos Creek watershed. In 1963, Nisene Marks State Park was created, totaling approximately 10,036 acres (excerpted from California Department of Parks and Recreation 2005).

Current Resources and Land Management

Land use in the watershed consists of forested lands, state parks, and rural residential areas. More than half of the (mainstem) Aptos Creek portion of the watershed is forested, with the majority of the creek running through the southern portion of Nisene Marks State Park. In this portion of the watershed there is very little rural residential development. Land use in the Valencia Creek portion of the watershed is primarily rural residential and urban development. Timber harvest occurs in both subwatersheds with the majority of recent timber management concentrated in the Valencia Creek subwatershed.

Salmonid Viability and Watershed Conditions

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

Current Conditions

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

Population and Habitat Conditions

Sediment Transport: Road Density

Excessive inputs of fine sediment in the Aptos Creek watershed have compromised spawning and rearing habitat which directly impact the egg and adult lifestages. High instream sediment levels were identified as the most likely limiting factor to salmonids on both a watershed and individual reach scale (CWC 2003a). Pool filling appears to have resulted from fine sediment transport from upslope sources with worse conditions in Valencia and Trout creeks than Aptos Creek. Sand dominates the substrate in both Valencia and Trout creeks (CWC 2003). Roads are the largest contributor of chronic fine sediment into Aptos Creek (CWC 2003a) although erosion from urban development (in the lower mainstem and Valencia Creek) and recreational trails are also a concern.

Estuary: Quality and Extent

The Aptos estuary has been reduced in size following settlement and substantial urbanization. The Aptos estuary was extensively converted from a functional estuary to urban uses and most of the historical tidal prism is reduced due to infill from permanent infrastructure (hardscape). Urban development in the tidal prism of the lagoon has severely constricted the lower lagoon to a width of approximately 70 feet between two vertical concrete levees that extend from the high water line of the ocean upstream approximately 300 feet (CWC 2003a). The substantial channelization through the historic main embayment of the lagoon also eliminated most of the deeper areas of the lagoon. During late winter and spring areas that retain sufficient residual depth in the estuary are especially important because they provide habitat for rapid spring feeding and saltwater transition for emigrating smolts. Urban encroachment, in addition to poor water quality from upstream sources and unauthorized lagoon breaching, has adversely affected the overall hydrology and water chemistry of the estuary. Furthermore, homeowners with property adjacent to the estuary often request local government agencies to address the meandering channel mouth when it may potentially threaten their beachside homes or inconvenience beach access, which often results in further encroachment into what remains of the natural estuary. Recent research suggests that the ability of juvenile salmonids to utilize functioning estuary/lagoon habitat can significantly improve juvenile survival, resulting in a concomitant increase in adult escapement (Bond *et al.*, 2008). Impaired lagoon function is a likely

a major limiting factor to the steelhead population in Aptos Creek, particularly smolts during spring.

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

According to NHI (2010), California coastal streams do not naturally exhibit channel morphology conducive to forming extensive flood plains or off-channel rearing areas as typically occurs within heavily forested watersheds of northern California and Oregon. Therefore LWD, as a formative agent for pool and slow water habitat is even more critical than in more northern streams of California. Habitat Complexity: Large wood conditions had an overall rating of Good however, none of the instream shelter values measured scored >80 and thus were rated Poor. This suggests instream shelter is compromised due to high sediment loading which may reduce the function and capacity of instream wood to create adequate shelter habitat. Habitat Complexity: Pool/riffle conditions have a rating of Poor, further indicating high sediment loading in Aptos Creek has reduced the number of available pools in the watershed. CWC (2003a) reported that much of the pool habitat, particularly in mainstem Aptos Creek, is in bedrock formed pools, which do not develop extensive undercut banks and do not recruit LWD to the same extent as habitats with softer banks. To improve shelter rating, LWD input should be evaluated in specific stream, geomorphically suitable areas to form instream pools in reaches where LWD rated below Very Good.

Velocity Refuge: Floodplain Connectivity

The limited floodplain limitations present today in the Aptos Creek watershed is primarily due to urbanization, existing roads and the associated effects of channel confinement from past channelization, which has resulted in riparian encroachment, channel degradation, and floodplain/stream channel disconnection. FEMA flood zone maps show significant overlap of areas designated as 100 year flood prone zones and areas with high housing density in the lower watershed. Due to the amount of development in these areas, the overall degraded condition of important floodplain areas (these are areas that were, under historical conditions, of high value to steelhead for spawning and rearing) is expected to persist and likely worsen in the future.

Landscape Patterns: Agriculture, Timber Harvest & Urbanization

Major landscape disturbance within Aptos Creek has resulted from residential development in the lower watershed and Valencia Creek and urbanization concentrated along the estuary. Development along the estuary is likely a major limiting factor for steelhead production in the watershed. Unlike nearby Soquel lagoon, the Aptos lagoon lacks a management plan and most issues associated with the lagoon tend to occur as reactionary measures associated with the channel mouth flowing to the sea along the beach in a southerly direction (along its historical alignment). These reactionary measures (e.g., "emergency" breaches or re-directing the flows

from the estuary to the ocean if the channel approaches adjacent homes) tend to result in further degradation of estuarine conditions.

Water Quality: Turbidity or Toxicity

Land-use practices in the watershed degrade water quality and negatively impact steelhead survival, principally through the input of fine sediment which results in increased turbidity, impacting the winter rearing and smolt lifestages. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging. The Valencia Creek portion of the watershed contributes significantly more to poor water quality conditions than the upper Aptos Creek portion of the watershed. The variable geology of the watershed and adjacent earthquake faults likely increases the likelihood of elevated levels of turbidity under background conditions. Ongoing land-use practices exacerbate the adverse effects of these background conditions.

The CWC (2003a) reported lagoon water quality was a primary factor limiting steelhead production in Aptos Creek. Water quality is compromised due to high rates of nutrient input that contribute to the formation of anoxic conditions in the lagoon. Phosphate and nitrates are primary sources that contribute to lagoon nutrient input, as well as fecal coliform and *enterococcus* bacteria (a bacterium found in the human intestine and a good indicator of contamination by human waste) (CWC 2003a). The causative factors creating poor water quality in Aptos Creek almost certainly originate from upstream anthropogenic land use practices.

Threats

The following discussion focuses on those threats that rate as High or Very High (See Aptos 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.

Fire and Fuel Management

Some areas in the Aptos watershed have a high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could greatly accelerate fine sediment input into a watershed already identified as being highly impacted by instream fine sediment. Furthermore, if existing riparian areas were lost to fire, instream temperatures, which are already above optimal condition in many stream reaches, would likely increase.

Residential and Commercial Development

The 2010 census estimated the human population within Aptos Creek at 5,788 individuals, 51 percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2015), with much of the development located in close proximity to the various watercourses, particularly the lower mainstem. The proximity of residences to stream channels places riparian areas and instream habitat at greater risk for future degradation. Many residences and commercial businesses are located on top of the historical estuary and are prone to flooding (as evidenced by being designated within the FEMA 100 year flood zone). Efforts to minimize the impacts of flooding will likely include removal of instream habitat features such as wood debris (a practice that is unauthorized, but still occurs due to some private streamside landowners concerned over potential flood risk). Residences located adjacent to stream channels are often at increased risk of bank erosion and efforts to protect existing infrastructure will likely include bank stabilization efforts which would further degrade salmonid habitat.

CWC (2003a) noted the high sediment loading in the Valencia Creek subwatershed of Aptos Creek was likely due to high rates of anthropogenic induced upslope disturbance leading to sediment mobilization. A major factor increasing sediment loading may be due to increased impermeable surfaces from development that alters the Valencia Creek hydrology, further increasing the accumulation of fine sediment and delaying recovery of instream habitats.

Roads

Road densities are high throughout the watershed, estimated at 3.7 miles of road per square mile of watershed area and 4.6 miles per square mile of riparian area. Actual road densities may be even higher as this estimate does not include seasonal roads used for timber harvest. Many of the roads in the watershed are poorly situated and constructed, because many are legacy roads from past logging activity. Many of these legacy roads have been adopted as year-round roads and recreational trails and continue to impact the water quality from high rates of sedimentation. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed (CWC 2003a). On many roads, located on both public and private lands, periodic maintenance occurs in the absence of any attempts to address chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossing can continue, and even exacerbate the rate, of fine sediment delivery. Additionally, paved and unpaved roads parallel many of the waterways within Aptos Creek (particularly in the lower half of the watershed) and impinge on channel migration. According to CWC (2003a), fine sediment source reduction from roads would be the most effective restoration action in terms of managing sediment loads to reduce aquatic habitat impairment.

Severe Weather Patterns

Concentrated rainfall and extreme flood events could result in major sediment input from upslope locations. Much of the watershed is comprised of steep topography in erodible geology leading to frequent landslides and chronic sediment input. High sediment concentrations from landslides would likely adversely impact spawning and rearing habitats. Changes and improvements in land use practices will likely lower sediment yield rates following future flooding events or periods of highly concentrated rainfall. However, much of the watershed is currently considered impaired and vulnerable during periods of severe weather and additional flooding events could slow the rate of recovery of instream habitat conditions.

Water Diversion and Impoundment

Aquatic conditions in the Aptos Creek watershed may be adversely affected by surface water diversions and ground water pumping. Due to the status of the Aptos Creek population, water diversions were rated as a High threat to smolts and summer rearing juveniles. Water extraction in the Aptos Creek watershed varies from year to year depending on the amount of rainfall received the previous winter and the seasonal weather patterns. Water is supplied to local residents primarily from groundwater. The County of Santa Cruz GIS database indicated there are records of approximately 250 private wells in the Aptos/Valencia watershed. However, no records are available regarding the quantity of water diverted from these wells (CWC 2003b). The impact of diversions on spring and summer baseflows (particularly during drought conditions) are unknown but, based upon impacts to baseflow in other watersheds in the Santa Cruz Mountains Diversity Stratum (e.g., San Gregorio, Pilarcitos, San Lorenzo, Soquel), adverse impacts are highly probable. The primary aquifers are located almost exclusively within the Valencia watershed (CWC 2003b) and additional research would improve the understanding of the relationship between groundwater pumping and baseflow hydrology in this basin.

Channel Modification

Channel modification was rated as a High threat in large part due to the significant alteration of the Aptos estuary. Modification has constricted and significantly reduced the historical tidal prism. Efforts to remediate these modifications to the channel would likely improve overall habitat quality and quantity. Applying recommendations to improve lagoon conditions as described in the *Aptos Creek Watershed Assessment and Enhancement Plan* (CWC 2003a) is recommended. The lagoon is compromised in its ability to support steelhead (Hagar Environmental Science 2003) though some juvenile steelhead still rear in the lagoon (Freund and MacFarlane 2005, Alley 2011, 12, 13).

Additionally, development along the stream banks has led some landowners to protect their property from erosion by removing vegetation and hardening the stream banks. This has

resulted in degradation of the riparian zone and has compromised riparian and instream habitat for salmonids. Due to the large amount of urban interface adjacent to the stream channels in lower Aptos Creek and Valencia Creek, it is likely that future bank hardening or maintenance of existing hardening will occur in areas that historically provided the best spawning and rearing habitats in the watershed.

Limiting Stresses, Life Stages, and Habitats

Threat and stress analysis within the CAP workbook indicates all life stages are impaired in the Aptos Creek watershed with summer rearing being the most stressed. Currently, low summer flow is likely the most significant limiting habitat attribute; residential development and the associated impacts of development are the most significant threats into the future.

General Recovery Strategy

Restore Aptos Creek Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Santa Cruz Mountains diversity stratum. Restoration should address issues impairing water quality and quantity, sandbar breaching, habitat availability and suitability. Efforts should focus on the ultimate causes of impairment as well as proximate issues limiting current habitat suitability. A comprehensive watershed-wide program to address sediment input and water quantity should be initiated. A focused effort to addressing illegal sandbar breaching and landowner concerns regarding channel migration should be initiated. The recommendations in the *Aptos Creek Watershed Assessment and Enhancement Plan* (CWC 2003a) for restoring estuarine habitat should be adopted and focused site specific studies (if necessary) should be implemented. It is likely that the Aptos estuary could be restored to a semblance (albeit reduced from its historical potential) of its biological potential through a focused and comprehensive effort. Admittedly, this effort will take time and developing partnerships will be essential to accomplishing this ambitious and complex task.

Improve Instream Habitat Quality and Quantity

Recovery actions should focus on improving spawning habitat by placing standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly sized trees could be felled into geomorphically suitable stream reaches to create these structures, particularly in upper mainstem Aptos Creek on lands managed by State Parks. Additionally, coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost

savings and serve as an opportunity for effective timber harvest plan mitigation (particularly for plans in the Valencia Creek watershed). Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring large wood should be left in place unless it can be demonstrated to threaten adjacent infrastructure.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a common problem throughout the watershed and likely the major limiting factor to steelhead production. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. The watershed is located in an area of rapid uplift, deep valleys, and seismic activity[1] in relatively weak rock (*i.e.,* unconsolidated Purisima sandstone formation) which means that landsliding and other forms of mass wasting are frequent occurrences. A variety of landslides ranging from shallow debris flows to rotational slumps over a hundred feet deep are found in the Aptos Creek watershed (CWC 2003a). These landslides make up a substantial proportion of the overall sediment budget for the watershed, particularly in Valencia and Trout creeks where landslides are common and urban development has exacerbated erosion. Areas identified as shallow or deep seated landslides should be protected from all future activities that could contribute to further instability. In particular, new roads and housing should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Floodplain

A lack of available winter refuge habitat, in part from limited access to inundated floodplain or off-channel habitats, is likely a limiting factor for steelhead in Aptos Creek. The lower mainstem of Aptos Creek and portions of Valencia Creek have been encroached upon by rural residential and urban development. Efforts should be made to assess the mainstem channel and low gradient stream reaches in the tributaries to target opportunities to restore floodplain connectivity. Restoring these existing areas may result in disproportionately beneficial effects to the population by providing key winter refuge habitats. Existing areas should be targeted for conservation easement, purchase of fee title, or establishment of a conservation bank(s).

[1] The geology of the Aptos watershed is dominated by the presence of the northwest-trending San Andreas Fault. The San Andreas Fault is considered to be very active, producing large magnitude seismic events, the most recent being the October 17, 1989, Loma Prieta earthquake. The epicenter of this 7.1 magnitude earthquake occurred within the Aptos Creek watershed in the Forest of Nisene Marks (excerpted from CWC 2003).

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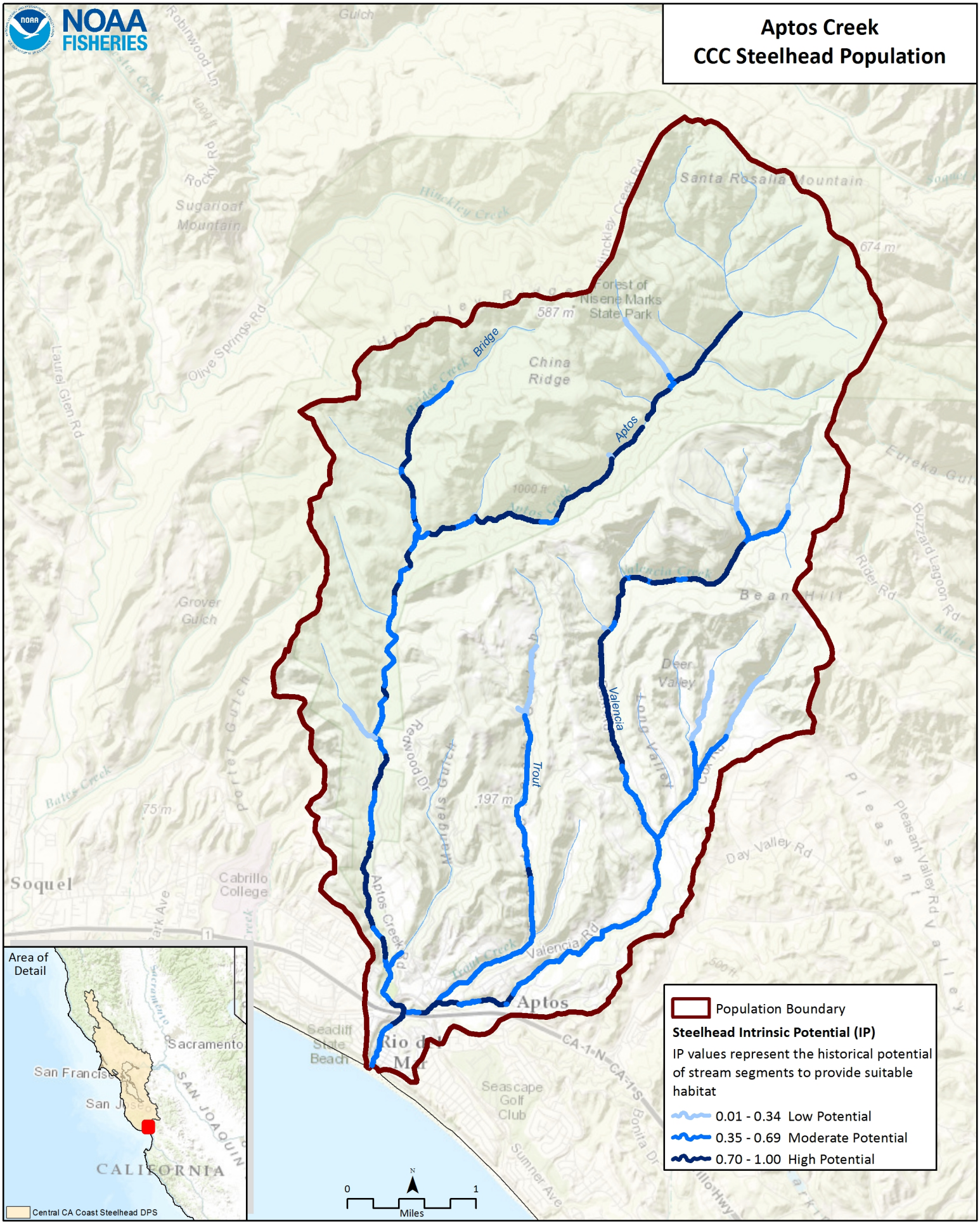
NOAA FISHERIES
Aptos Creek
CCC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Central CA Coast Steelhead DPS
Sacramento
San Francisco
San Jose
CALIFORNIA
SAN JOAQUIN
Aptos
Soquel
Cabrillo College
Seacliff State Beach
Rio del Mar
Seascape Golf Club
Santa Rosalia Mountain
Forest of Nisene Marks State Park
China Ridge
Bean Hill
Deer Valley
Sugarloaf Mountain
Grover Gulch
Aptos
Bridge
Valencia
Trout
Aptos Creek Rd
Valencia Rd
Day Valley Rd
Pleasant Valley Rd
Olive Springs Rd
Laurel Glen Rd
Rocky Rd
Rider Rd
Buzzard Lagoon Rd
Eureka Gulch
Sumner Ave
Bonita Dr
CA-1-N
CA-1-S
0
1
Miles
N

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% 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)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	25% streams/ 49% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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		Not Specified
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km 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	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<1 spawner per IP-km 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)	>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)	25% streams/10% IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% 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)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	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)	25% streams/ 49% 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)	25% streams/ 49% 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 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.37 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	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where	>90% of streams/ IP-Km (>70% average stream canopy; >85% where	87% of streams/ IP-km (>70% average stream canopy; >85%	Good

					coho IP overlaps)	coho IP overlaps)	steelhead IP overlaps)	coho IP overlaps)	where steelhead IP overlaps)	
			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		Not Specified
			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	70%-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	25% of streams/ 10% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50% to 74% IP-km (<20 C MWMT; <16 C MWMT where steelhead IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50% to 74% IP-km (<20 C MWMT; <16 C MWMT where steelhead IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75%-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% 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)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	25% streams/ 49% 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)		Not Specified
			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	N/A	Not Specified
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	25% streams/10% 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		Not Specified
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	0.37 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	1.74% 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	2.12% of Watershed in Agriculture	Very Good

			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	7% 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	51% of watershed >1 unit/20 acres	Poor
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	3.7 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	4.6 Miles/Square Mile	Poor

Aptos Creek CAP Threat Results

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

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat										
ApC-CCCS-1.1.1.1	Action Step	Estuary	Evaluate restoration benefits to tidal prism by reducing the size of the Esplanade Parking Lot.	3	20	CA Coastal Commission, IWRP, Santa Cruz RCD, State Parks						0	A feasibility and benefits analysis should be conducted, prior to proceeding further with this recommendation. Reducing the size of the parking lot next to the estuary could increase the total quantity of lagoon habitat. Lagoon habitat could include greater wetted area or installation of a buffer zone. A buffer could benefit the lagoon by trapping some pollutants prior to entering the water. Reducing the size of the parking lot would likely be expensive and costs are uncertain due to unknown infrastructure constraints that would likely result in increased expenditures above a typical road decommissioning project. Additionally, this parking lot is popular with the local community because it provides easy beach access and parking is free. Action is considered In-Kind
ApC-CCCS-1.1.1.2	Action Step	Estuary	Narrow Moosewood Drive and/or State Parks property down to one lane to expand overall tidal prism.	3	20	County of Santa Cruz Department of Public Works, State Parks						TBD	Opportunities to improve estuarine function in Aptos estuary are extremely limited due to significant infrastructure located within the historical estuary tidal prism. Narrowing the drive may be infeasible due to political and social constraints. The ecological benefits should be carefully evaluated prior to moving forward with this recommendation. Prior to implementing this alternative, a feasibility and benefits analysis should be conducted. Narrowing the road could increase the total quantity of lagoon habitat. Lagoon habitat could include greater wetted area or installation of a riparian buffer zone. A riparian buffer could benefit the lagoon by trapping some pollutants prior to entering the water and increase shading which would help to reduce water temperature during the summer. The road narrowing would likely be expensive and costs are uncertain due to unknown infrastructure constraints that would likely result in increased expenditures above a typical road decommissioning project in a less impacted location.
ApC-CCCS-1.1.1.3	Action Step	Estuary	Develop and implement strategies to increase the current extent of the estuary/lagoon in efforts to increase high value habitat for migrating and rearing salmonids.	3	30	CA Coastal Commission, IWRP, County of Santa Cruz, State Parks						TBD	
ApC-CCCS-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-1.1.2.1	Action Step	Estuary	Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.	2	5	CDFW Law Enforcement, IWRP, NMFS OLE, County of Santa Cruz, State Parks, USFWS						0	Action is considered In-Kind
ApC-CCCS-1.1.2.2	Action Step	Estuary	Allow the stream mouth to breach naturally.	1	100	State Parks						TBD	TBD, based on the feasibility of removing infrastructure and adopting management policies to allow stream mouth to breach naturally.
ApC-CCCS-1.1.3	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										
ApC-CCCS-1.1.3.1	Action Step	Estuary	Minimize construction of new buildings and associated infrastructure within remaining open areas of the Aptos estuary tidal prism.	1	100	County of Santa Cruz, State Parks, USACE						0	Aptos estuary has been reduced in size following European arrival and especially after the development of Rio Del Mar in the 1930's. The Aptos estuary was extensively converted from a functional estuary to urban uses and most of the historical tidal prism has been reduced due to infill from permanent infrastructure (hardscape). Urban development in the tidal prism of the lagoon has severely constricted the area to a width of approximately 70 feet between two vertical concrete levees that extend from the high water line of the ocean upstream approximately 300 feet (CWC and SHG 2003). Action is considered In-Kind
ApC-CCCS-1.1.4	Recovery Action	Estuary	Improve the quality of estuarine habitat zones										
ApC-CCCS-1.1.4.1	Action Step	Estuary	Evaluate and implement programs to enhance native riparian and wetland flora, reducing habitat related effects of past or present land-uses.	3	5	IWRP, Santa Cruz RCD, State Parks	384.75					385	Areas at the upper end of the estuary should be initially targeted. Improved riparian vegetation composition could benefit lagoon conditions by reducing water temperature and providing a source of macroinvertebrate production. Cost based on treating 50% of 9 acres of estuarine habitat at a rate of $85,500/acre.
ApC-CCCS-1.1.5	Recovery Action	Estuary	Increase and enhance habitat complexity features										
ApC-CCCS-1.1.5.1	Action Step	Estuary	Identify key locations and install large wood structures (or other appropriate surrogate) targeting increased pool depth and shelter within the estuary.	2	10	IWRP, County of Santa Cruz, Santa Cruz RCD, State Parks, USFWS	118.50	118.50				237	Cost based on treating 1 mile of estuary at a rate of $118,560/ELJ. Installation of ELJ should be in concert with increasing other elements such as aquatic cover, instream boulders, and riparian vegetation to reduce the redundancy of design and permitting.
ApC-CCCS-1.1.5.2	Action Step	Estuary	Remove and replace exotic tree and understory species in the stream reaches above the lagoon.	3	10	State Parks	32.00	32.00				64	Cost based on treating 0.5 miles of high IP at a rate of $85,500/mile for planting and $41,000/acre of thinning.
ApC-CCCS-1.1.6	Recovery Action	Estuary	Reduce toxicity and pollutants										
ApC-CCCS-1.1.6.1	Action Step	Estuary	Evaluate and repair private sewer laterals, particularly in areas subject to high groundwater adjacent or upstream of the estuary.	3	10	County of Santa Cruz						TBD	An inventory of stormwater sewer systems will identify problematic sewer laterals. It is likely Santa Cruz County has this information. TBD cost of repairs will be accounted for once assessment of sewer system is conducted.

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-1.1.6.2	Action Step	Estuary	Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.	3	100	RWQCB, County of Santa Cruz							Cost already accounted for water quality assessment.
ApC-CCCS-1.1.7	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										
ApC-CCCS-1.1.7.1	Action Step	Estuary	Evaluate and implement possible structural improvements to maintain lagoon water surface elevations during the summer through the late fall.	3	10	CA Coastal Commission, California Coastal Conservancy, IWRP, County of Santa Cruz, Santa Cruz RCD, State Parks						TBD	Evaluation should include input from scientists familiar with coastal watershed dynamics. Cost cannot be determined until evaluation of potential structural improvements is completed. Anticipate estuary assessment will identify structural improvements.
ApC-CCCS-1.1.7.2	Action Step	Estuary	Evaluate benefits of installation of a flume to control water surface elevation in the lagoon during summer and fall.	3	10	CA Coastal Commission, IWRP, County of Santa Cruz, Santa Cruz RCD, State Parks, USFWS						TBD	Nearby Soquel Creek estuary flume operated by the City of Capitola should serve as a model for evaluation. Operation of the flume by the City of Capitola costs approximately $70,000 per year (this includes a monitoring component). Flume installation could allow sanctioned and effective management of Aptos Creek lagoon and minimize annual "emergency" declarations by beach front landowners.
ApC-CCCS-1.1.7.3	Action Step	Estuary	Initiate a program to ensure sandbar integrity across the mouth of Aptos Creek during the summer and fall low flow period.	1	15	CA Coastal Commission, IWRP, County of Santa Cruz, Santa Cruz RCD, State Parks, USFWS						0	Action is considered In-Kind
ApC-CCCS-1.1.7.4	Action Step	Estuary	Maximize lagoon depth throughout the summer season.	2	100	State Parks						TBD	TBD based on the type of management (passive vs. active) alternatives are suitable for lagoon enhancement.
ApC-CCCS-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-1.2.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
ApC-CCCS-1.2.1.1	Action Step	Estuary	Isolate and correct source of impaired water quality in the lower Aptos Creek watershed.	3	10	RWQCB, County of Santa Cruz	7.50	7.50				15	Swanson Hydrology and Geomorphology et al. (2003), in a review of water quality monitoring information from the Santa Cruz Health Dep, identified elevated levels of nutrients entering the lower portion of the watershed, primarily from Valencia Creek. Source is unknown but it has been hypothesized that a leaking sewer pipe may be a major source of contamination. Additional efforts should include working with landowners in the Valencia watershed to ensure septic systems are in compliance with State standards. All identified sources of water quality degradation should be corrected. Cost based on installing a minimum of 3 continuous water quality stations at a rate of $5,000/station. Cost does not account for data management or maintenance.

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-1.2.1.2	Action Step	Estuary	Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.	3	100	County of Santa Cruz						0	Maintain existing programs for prompt cleanup of sewage spills and correction of problems with private sewer laterals that cause chronic leaks. Action is considered In-Kind
ApC-CCCS-1.2.1.3	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	10	CDFW, Central Water District, NMFS, Private Landowners, SWRCB						0	Work would entail SWRCB reviewing all existing water diversions and contacting diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to bring into compliance which is reflected in the tentative cost estimate. Action is considered In-Kind
ApC-CCCS-1.2.1.4	Action Step	Estuary	Encourage repaving and application of petrochemicals in the early summer to allow penetration and drying before fall rains.	3	100	CalTrans, County of Santa Cruz, State Parks						0	Action is considered In-Kind
ApC-CCCS-1.2.1.5	Action Step	Estuary	Use gull-proof lids on refuse cans at and around the lagoon and beach.	3	50	State Parks	1.00	1.00	1.00	1.00	1.00	2	Use enough refuse containers to satisfy the demand for refuse disposal. Gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria (Alley 2009). Cost based on increasing and replacing refuse containers.
ApC-CCCS-1.2.1.6	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	3	10	IWRP, County of Santa Cruz	75.00	75.00				150	Urban encroachment has adversely affected the overall hydrology and water chemistry of the estuary. Urbanization has also lead to the estuary being affected by poor water quality from upstream sources and unauthorized lagoon breaching,. Water quality assessment based on a cost of $5000/site for continuous monitoring, with a minimum of 3 sites within the lagoon. Cost could be significantly higher if additional sites are needed to identify source of pollution to estuarine water quality.
ApC-CCCS-1.2.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ApC-CCCS-1.2.2.1	Action Step	Estuary	Encourage State Parks and County of Santa Cruz to fence off lagoon with temporary fencing rather than breach lagoon as a precaution to protect public health and safety.	3	3	CDFW, County of Santa Cruz, State Parks						0	Costs will vary and will depend on variation in river mouth configuration. Action is considered In-Kind
ApC-CCCS-1.2.2.2	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	5	County of Santa Cruz, Santa Cruz RCD, State Parks	3.00					3	Additional educational signage along the estuary should be included with this recommendation. Signage should explain estuarine function and the benefits to endangered species and water quality of a properly functioning estuary. Cost of signs varies widely depending on materials used and content. Assume average cost of sign being $1,000/sign with a minimum of 3 posted near estuary.
ApC-CCCS-1.2.2.3	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.	2	100	NMFS, County of Santa Cruz, State Parks						0	Close coordination by all parties would likely comprise the majority of the costs. Other methods should also be evaluated such as installation of cameras that provide real time oversight. Action is considered In-Kind
ApC-CCCS-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
ApC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment of natural riparian communities. Prioritize mainstem Aptos Creek as well as the lagoon.	2	100	CDFW, County of Santa Cruz, County of Santa Cruz Land Trust, The Nature Conservancy, Trust for Public Lands						TBD	Costs associated with development and implementation of this program are currently difficult to determine. Costs will vary significantly depending on market conditions, landowner participation, and programs actually used.
ApC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD, USACE	85.00	85.00				170	Costs will vary significantly depending on site specific constraints and type of structure constructed. Many of the historical floodplain areas have been built upon. Remaining floodplains should be considered a high priority for preservation and enhancement actions. Assuming base application of restoring floodplain, cost based on treating 2 miles (assume 1 project/mile in 25% High IP) at a rate of $42,448/mile.
ApC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
ApC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Work with the County and CDFW to develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	25	CDFW, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Install large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	5	IWRP, Private Landowners, County of Santa Cruz, State Parks	476.00					476	Cost based on treating 2 miles (assume 1 project/mile in 25% High IP) at a rate of $119,080/ELJ. Available information indicates large woody material may not be limiting in upper Aptos and therefore we recommend initial efforts be directed at the lower reach, which may respond to LWD input. Costs are higher when engineered large wood placement approaches are used. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the watershed was allowed to stay in place. Unsecured LWD input should be evaluated for the portion of Aptos managed by State Parks and if feasible, significant cost saving could result over engineered structures.

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ApC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to steelhead survival and recovery, and watershed processes.	1	5	CalFire, CDFW, NMFS, NRCS, County of Santa Cruz Department of Public Works, Santa Cruz RCD, USACE						0	Costs would likely be minimal, consisting of staff time for public outreach and outreach materials. Action is considered In-Kind
ApC-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	NOAA RC, NRCS, Private Landowners, RWQCB, County of Santa Cruz Land Trust, Santa Cruz RCD, State Parks, USACE						0	Cost should be minimal. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. Action is considered In-Kind
ApC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Encourage retention of large woody debris for all historical steelhead rearing habitats in Aptos Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CalFire, County of Santa Cruz, Santa Cruz RCD, State Parks						0	Manipulation of Large Woody Material should not occur until evaluated by the County of Santa Cruz staff and hydrologist and/or qualified biologist familiar with Central Coast streams. State Parks should approach LWM manipulation with caution due to the importance of upper Aptos as a source of LWM recruitment. Action is considered In-Kind
ApC-CCCS-6.1.1.6	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	3	100	CDFW, NRCS, County of Santa Cruz, Santa Cruz RCD, State Parks, USACE						0	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Valencia Creek and it's tributaries should be the focus on these LWM supplementation projects. Action is considered In-Kind
ApC-CCCS-6.1.1.7	Action Step	Habitat Complexity	Conserve and manage forestlands for older forest stages.	2	100	Private Landowners, NMFS						0	Action is considered In-Kind
ApC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Improve shelter										
ApC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, NRCS, Private Landowners, RPFs, County of Santa Cruz, Santa Cruz RCD	160.50	160.50				321	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost could be minimal if incorporated into ongoing timber harvest plans. The upper portion of the watershed is managed by State Parks and much of the riparian zone is in later serial age classes. Cost for treating 1.2 miles (assume 80 acre/mile in 15% High IP) at a rate of $1,674/acre.
ApC-CCCS-6.1.4	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										

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ApC-CCCS-6.1.4.1	Action Step	Habitat Complexity	Increase the frequencies of riffle habitat in 75% of the streams within the watershed.	2	20	Private Landowners, RPFs, County of Santa Cruz, Santa Cruz RCD						0	Cost accounted for in above action steps (i.e. increase frequency of primary pools).
ApC-CCCS-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
ApC-CCCS-8.1.1.1	Action Step	Sediment	Prioritize and treat erosion sources in Table 11 of the Aptos Geomorphic and Erosion Source Technical Report.	2	15	California Geological Survey, CDFW, NMFS, NRCS, Santa Cruz RCD						TBD	Review Table 11 to develop appropriate recovery actions.
ApC-CCCS-8.1.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, California Geological Survey, CDFW, NMFS, RWQCB, County of Santa Cruz, USACE						0	This should be considered a standard practice by all regulatory agencies. Action is considered In-Kind
ApC-CCCS-8.1.1.3	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into Aptos Creek.	3	5	IWRP, NRCS, Private Landowners, County of Santa Cruz, County of Santa Cruz Parks and Cultural Resources	112.00					112	Ultimate reasons for bank failure should be identified and addressed. Bank and landslide stabilization should evaluate a full range of options to address instability such as setting back or removing problematic infrastructure (roads, etc). Bioengineering should be the first stabilization method assessed. Bank hardening is not a preferred alternative. Initial efforts should be directed along the mainstem of Aptos Creek. A sediment assessment is estimated to cost $111,651 (assume 5% of total watershed acres at a rate of $1,578/acre).
ApC-CCCS-8.1.1.4	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	20	IWRP, NRCS, Private Landowners, County of Santa Cruz, County of Santa Cruz Parks and Cultural Resources						0	Action is considered In-Kind
ApC-CCCS-8.1.1.5	Action Step	Sediment	Initiate education program for landowners in the watershed regarding practices to minimize sediment input.	3	20	CDFW, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-8.1.1.6	Action Step	Sediment	Work with the County and CDFW to establish and/or maintain continuous native riparian buffers.	3	100	CDFW, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-8.1.1.7	Action Step	Sediment	Assess landslide stabilization and sediment source reduction.	3	5	CDFW	20.00					20	Cost based on erosion assessment of 10% of total watershed acres at a rate $14.38/acre.
ApC-CCCS-8.2	**Objective**	**Sediment**	**Address the inadequacy of existing regulatory mechanisms**										

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-8.2.1	Recovery Action	Sediment	Improve instream gravel quality to reduce embeddedness										
ApC-CCCS-8.2.1.1	Action Step	Sediment	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.	3	20	CDFW, CDFW Law Enforcement, County of Santa Cruz, NMFS OLE						0	Action is considered In-Kind
ApC-CCCS-8.2.1.2	Action Step	Sediment	Permitting agencies and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	25	CDFW, Corps, CWQCB, NMFS						0	Action is considered In-Kind
ApC-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
ApC-CCCS-10.1.1.1	Action Step	Water Quality	Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.	2	5	CDFW, NMFS, Public, State Parks	5.00					5	Temperature monitoring is relatively inexpensive. A thermograph should be installed in each tributary and in mainstem locations above and below each major confluence. Results should be compiled in one document and submitted to all participants and appropriate regulatory agencies on a yearly basis. Standard presentations should be used. Cost for stream temperature monitoring estimated at $500/gauge with a minimum of 10. Cost do not account for maintenance or data management.
ApC-CCCS-10.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants										
ApC-CCCS-10.1.2.1	Action Step	Water Quality	Remove invasive exotic vegetation at problematic sites, such as the Old Mill site, and revegetate with native plants.	3	20	IWRP, RWQCB, County of Santa Cruz, Santa Cruz RCD	900	900	900	900		3,600	Costs will vary depending on degree of infestation and landowner participation. Cost based on treating 0.25 mile (assume 80 acres/mile-) at a rate of $45,114/acre.
ApC-CCCS-10.1.2.2	Action Step	Water Quality	Install continuous water quality samplers in and adjacent to Mangels Gulch, Trout Gulch, and Valencia Creek.	2	6	IWRP, RWQCB, County of Santa Cruz, Santa Cruz RCD	66.67	13.33				40	This is a high priority action in the Aptos Creek Watershed Assessment (CWC and SHG 2003), due to known water quality issues. Cost based on installation of continuous monitoring gauges (2) at a rate of $20,000 each; cost does not account for maintenance and operation.
ApC-CCCS-10.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										

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ApC-CCCS-10.1.3.1	Action Step	Water Quality	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	County of Santa Cruz						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.
ApC-CCCS-10.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10	IWRP, NMFS, RWQCB, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
ApC-CCCS-10.1.3.3	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming and Ranching program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100	IWRP, NMFS, RWQCB, County of Santa Cruz, Santa Cruz RCD						0	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort. Action is considered In-Kind
ApC-CCCS-10.2	**Objective**	**Water Quality**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-10.2.1	Recovery Action	Water Quality	Improve stream temperature conditions										
ApC-CCCS-10.2.1.1	Action Step	Water Quality	Encourage County of Santa Cruz to establish wider riparian buffers and enforce existing ordnances in residential and urban areas.	2	10	County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-10.2.1.2	Action Step	Water Quality	Plant native vegetation to promote streamside shade.	3	10	CDFW, Santa Cruz RCD	113.50	113.50				227	Cost based on treating 1.2 miles (assume 1 project/mile in 15% high IP with 80 acres/mile) at a rate of $23,619/acre.
ApC-CCCS-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										
ApC-CCCS-11.1.1.1	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	3	5	CDFW	131.00					131	Cost based on fish/habitat restoration model at a rate of $130,941/project.
ApC-CCCS-11.1.1.2	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	3	100	CDFW, Central Water District, NOAA SWFSC, RWQCB, State Parks						0	Periodic surveys (redd surveys may be the most viable survey method in Aptos Creek) are likely the preferred alternative in Aptos due to the other adult monitoring all ready occurring in other watersheds in the Santa Cruz Mtn. Diversity Stratum that provide lifecycle calibration. Cost accounted for in Monitoring Chapter.

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ApC-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.	2	10	California Coastal Conservancy, CDFW, Central Water District, NMFS, RWQCB, Santa Cruz RCD, Soquel Creek Water District, State Parks						TBD	The existing watershed plan for Aptos should be updated and a limiting factors analysis should be conducted. Future watershed plan should develop site specific recommendations to increase survival for all life stages - not just develop recommendations to increase capacity (i.e. fish passage projects). Measures should be developed that identify and prioritize restoration actions for high value IP-km. TBD cost based on the parameters (sediment, erosion, fisheries) needed in watershed plan are highly variable.
ApC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ApC-CCCS-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Department of Mines and Geology, CalTrans, FEMA, NRCS, Private Landowners, Santa Cruz RCD, State Parks, USACE						0	Costs will vary depending on extent and location of streambank work. Gabions and undersized rock are often used because they are cheaper than larger and more stable rock features. USDA estimated stream bank protection projects in general coast about 125 dollars per square foot in California. This recommendation should be considered standard practice. Action is considered In-Kind
ApC-CCCS-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	3	100	CalTrans, FEMA, RWQCB, County of Santa Cruz						0	This recommendation should be adopted as standard practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation. Action is considered In-Kind
ApC-CCCS-13.1.1.3	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	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Public, County of Santa Cruz, Santa Cruz RCD						0	This should become standard practice for all agencies and consulting firms engaged in constructing and designing solutions to address channel stability. Action is considered In-Kind
ApC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										

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ApC-CCCS-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.	3	100	CalFire, California Geological Survey, CalTrans, CDFW, FEMA, NRCS, Private Landowners, Santa Cruz RCD, State Parks, USACE						TBD	A significant portion of the estuary has been lost due to channel modification. Any additional proposals within the extant estuary should result in a net gain in habitat complexity.
ApC-CCCS-13.1.2.2	Action Step	Channel Modification	Establish fire contingency plan developed by experts from CalFire, local fire districts, landowners, and regulatory agencies with expertise in fisheries issues.	3	20	CalFire, California CDFW, Private Landowners, State Parks						0	Action is considered In-Kind
ApC-CCCS-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize adverse alterations to riparian species composition and structure										
ApC-CCCS-14.1.1.1	Action Step	Disease/ Predation/ Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation (i.e., eucalyptus, acacia, cape ivy) within the stream and riparian corridor.	3	20	Private Landowners, Santa Cruz RCD						0	Initial efforts should be directed at landowners in Mangels Gulch and the Valencia Creek watershed. These areas have the greatest concentration of rural residential landowners most likely to foster exotic invasives. Cost accounted for in WATER QUALITY.
ApC-CCCS-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ApC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire						0	This recommendation should be considered a standard practice. Action is considered In-Kind
ApC-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, State Parks						0	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
ApC-CCCS-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire						0	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out.
ApC-CCCS-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						0	Action is considered In-Kind
ApC-CCCS-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide a fire contingency plan to all non-County fire fighters when providing firefighting assistance in the Aptos Creek watershed (and all other watersheds in the County).	2	100	CalFire						0	Action is considered In-Kind
ApC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										

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ApC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire						0	Action is considered In-Kind
ApC-CCCS-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
ApC-CCCS-15.1.3.1	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	3	25	CalFire						0	Action is considered In-Kind
ApC-CCCS-15.1.3.2	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	3	10	CalFire, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-15.1.3.3	Action Step	Fire/Fuel Management	Reassess fire risk every ten years.	2	100	CalFire, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ApC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate recommendations from NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	2	CalFire, NMFS, RWQCB						0	Action is considered In-Kind
ApC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-15.2.1.3	Action Step	Fire/Fuel Management	Avoid use of toxic aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC steelhead.	2	100	CalFire, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-15.2.1.4	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to site water quality and the structure of the biological community.	3	10	CalFire, CDFW, NMFS, RWQCB						0	Action is considered In-Kind
ApC-CCCS-15.2.1.5	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire						0	Action is considered In-Kind
ApC-CCCS-15.2.1.6	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed rural development on fire suppression and fuel load buildup.	2	10	CalFire, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-15.2.1.7	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.	2	20	CalFire						0	Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity										
ApC-CCCS-16.1.1.1	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFW, NMFS						0	Action is considered In-Kind
ApC-CCCS-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CDFW						0	If river mouth has been artificially breached without appropriate authorization, prohibitions on offshore fishing should continue until appropriate flows occur. Action is considered In-Kind
ApC-CCCS-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFW to modify Section 8.00 (b) (1) of Title 14 of the California Code of Regulations to specify a low flow minimum flow closure for Aptos Creek and to modify the fishing season to be more protective of steelhead.	2	3	CDFW, NMFS						0	Low flow closures are needed for Aptos Creek and should be based on flow conditions from a watershed in the Santa Cruz Mountains (the San Lorenzo River would likely suit this requirement). Additionally, due to later (recent) migration patterns of CCC steelhead in the streams south of the Golden Gate, the date of opening season should be pushed forward in the fishing season (currently fishing season starts on December 15) to at least January 15. Consideration should be given to pushing forward the entire fishing season so that the total number of angling days is not reduced significantly. Action is considered In-Kind
ApC-CCCS-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ApC-CCCS-21.1.1.1	Action Step	Recreation	Encourage development of a trail management plan/maintenance guidelines for Forest of Nisene Marks State Park. Use plan to develop a program to reduce erosion, decommission illegal or duplicate trails, and keep users on designated trails.	2	4	Santa Cruz RCD, State Parks						0	Development of a management plan should be relatively inexpensive if it draws from existing guidelines and sediment reduction protocols. Action is considered In-Kind
ApC-CCCS-21.1.1.2	Action Step	Recreation	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	2	10	CalFire, RWQCB, County of Santa Cruz Land Trust, County of Santa Cruz Parks and Cultural Resources, Santa Cruz RCD, State Parks	28.50	28.50				57	Cost will vary depending on trail location and accessibility. Cost based on decommissioning 2 miles of trail at a rate of $14,131/mile. Cost may be lower for trails due to overall size and footprint and may range from $3,000 per mile to $23,000 per mile according to estimates in the State Multispecies Recovery Plan.
ApC-CCCS-21.1.1.3	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about salmon and how to minimize impacts.	2	5	NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD, State Parks	10.00					10	Cost for signs vary widely depending on materials used and content of signs. Assume signs average $500/sign for 20 signs.

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-21.1.1.4	Action Step	Recreation	Ensure roads, and landings are winterized prior to winter rains according to California Forest Practice Rules standards under section 923.5	2	100	CalFire, Farm Bureau, Private Landowners, State Parks						TBD	Costs will vary depending on access, prior weatherization practices, and severity of the problem. These data are currently unavailable.
ApC-CCCS-21.1.1.5	Action Step	Recreation	Educate users (including mountain bikers, hikers, ORV users, etc) to help prevent or control erosion and sediment problems along the stream.	3	10	CalFire, Farm Bureau, Private Landowners, State Parks						0	Action is considered In-Kind
ApC-CCCS-22.1	**Objective**	**Residential /Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-22.1.1	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-22.1.1.1	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	RWQCB, County of Santa Cruz						0	This recommendation should be considered as a higher priority in subbasins with highly erodible soils (e.g., Valencia Creek sub-watershed). Action is considered In-Kind
ApC-CCCS-22.1.2	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ApC-CCCS-22.1.2.1	Action Step	Residential /Commercial Development	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC steelhead watercourse.	2	100	FEMA, NMFS, Private Landowners, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.1.2.2	Action Step	Residential /Commercial Development	Minimize sediment input from existing and future commercial development. Reduce to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over what would occur naturally.	2	100	County of Santa Cruz						TBD	General recommendation that should be applied to all pre-existing and future landuse activities in the watershed.
ApC-CCCS-22.1.3	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCCS-22.1.3.1	Action Step	Residential /Commercial Development	Design new development to allow streams to meander in historical patterns, protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	RWQCB, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.1.3.2	Action Step	Residential /Commercial Development	Santa Cruz County 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	FEMA, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.1.4	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
ApC-CCCS-22.1.4.1	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.	3	10	County of Santa Cruz						0	Outreach to landowners already occurs from many of the municipalities and water districts in the watershed. Action is considered In-Kind
ApC-CCCS-22.1.5	Recovery Action	Residential /Commercial Development	Prevent or minimize increased landscape disturbance										
ApC-CCCS-22.1.5.1	Action Step	Residential /Commercial Development	Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	County of Santa Cruz						0	This action encourages implementation of many existing policies. Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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ApC-CCCS-22.1.5.2	Action Step	Residential /Commercial Development	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100	IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
ApC-CCCS-22.1.5.3	Action Step	Residential /Commercial Development	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	1	100	Private Landowners, County of Santa Cruz, County of Santa Cruz Land Trust, State Parks						TBD	Cost are difficult to determine due to feasibility of conservation easements, participation of landowners, current fair market value, and rate of turnover.
ApC-CCCS-22.1.5.4	Action Step	Residential /Commercial Development	Minimize impacts from new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	1	100	CalFire, California Geological Survey, CDFW, NMFS, RWQCB, County of Santa Cruz, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
ApC-CCCS-22.2	**Objective**	**Residential /Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-22.2.1	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
ApC-CCCS-22.2.1.1	Action Step	Residential /Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	2	5	County of Santa Cruz						0	The weakness of the County of Santa Cruz's existing riparian ordinance stems from exemptions allowed for pre-existing development. County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs mainstem. Incentives should be investigated to encourage landowners in key areas to allow establishment of a riparian buffer. Action is considered In-Kind
ApC-CCCS-22.2.1.2	Action Step	Residential /Commercial Development	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.2.2	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ApC-CCCS-22.2.2.1	Action Step	Residential /Commercial Development	Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the Aptos Creek Watershed.	2	100	RWQCB, County of Santa Cruz, USEPA						0	This recommendation should be carefully balanced against expansion of rural residential development over a wider landscape. Action is considered In-Kind
ApC-CCCS-22.2.2.2	Action Step	Residential /Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	3	100	RWQCB, County of Santa Cruz, USEPA						0	Action is considered In-Kind
ApC-CCCS-22.2.2.3	Action Step	Residential /Commercial Development	New development in all historical CCC steelhead watersheds should be designed to minimize increase in storm-water runoff, changes in duration, or magnitude of peak flow.	2	20	RWQCB, County of Santa Cruz, USEPA						0	Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-22.2.3	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-22.2.3.1	Action Step	Residential /Commercial Development	Implement ordinances and policies so new development are designed to minimize storm water runoff, changes in duration or magnitude of peak flow.	2	10	RWQCB, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.2.3.2	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	15	RWQCB, County of Santa Cruz						TBD	Implementation of this recommendation will help reduce rates of channel incision, increase aquifer recharge, and reduce the likelihood of redd scour.
ApC-CCCS-22.2.3.3	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	10	SWRCB						0	Action is considered In-Kind
ApC-CCCS-22.2.3.4	Action Step	Residential /Commercial Development	Develop an incentive program for a roof runoff collection system for detaining runoff and providing for landscape irrigation.	2	10	RWQCB, County of Santa Cruz						TBD	Cost based on amount of incentives to provide. Currently, existing programs are in place and should be explored and identified.
ApC-CCCS-22.2.3.5	Action Step	Residential /Commercial Development	Support the development and implementation of regulations for activities that adversely impact groundwater recharge.	3	100	RWQCB, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.2.4	Recovery Action	Residential /Commercial Development	Prevent or minimize increased landscape disturbance										
ApC-CCCS-22.2.4.1	Action Step	Residential /Commercial Development	Discourage Counties from rezoning forestlands to rural residential.	1	100	County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.2.4.2	Action Step	Residential /Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	City of Santa Cruz, City of Scotts Valley, County of Santa Cruz						0	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality. Action is considered In-Kind
ApC-CCCS-22.2.4.3	Action Step	Residential /Commercial Development	Work with CalFire and the county to review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, County of Santa Cruz						0	Applications are currently approved without appropriate review. Fire-safe exemptions are provisions that allow landowners to clear their properties (riparian zones) of vegetation due to fire concerns. Action is considered In-Kind
ApC-CCCS-22.2.5	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCCS-22.2.5.1	Action Step	Residential /Commercial Development	Minimize future urban development in floodplains or off channel habitats.	2	100	County of Santa Cruz						TBD	
ApC-CCCS-22.2.5.2	Action Step	Residential /Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	County of Santa Cruz						0	The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection. Action is considered In-Kind
ApC-CCCS-22.2.5.3	Action Step	Residential /Commercial Development	Modify all County General Plans to prevent or minimize new construction in undeveloped areas within the 100-year flood prone zones in all historical CCC coho salmon and CCC steelhead watersheds.	1	10	County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-22.2.5.4	Action Step	Residential /Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.	3	100	County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalTrans, County of Santa Cruz						TBD	Cost of implementation will likely be high due to the large amount of existing infrastructure. This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides rather than maintained and highly traveled surface roads. Due to the friable geology in the Valencia Creek, major benefits to sediment remediation could be achieved if roads are properly decommissioned in this sub-watershed.
ApC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	5	CalTrans, NRCS, RWQCB, County of Santa Cruz, State Parks, USACE	1,313					1,313	All new and replacement culverts should be sized to accommodate a 100 year flow event. Cost based on treating five stream crossings at a rate of $262,669/unit.
ApC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	2	10	CalFire, CDFW, NOAA RC, County of Santa Cruz, Santa Cruz RCD	15.00	15.00				30	This action encourages implementation of many existing policies.
ApC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ApC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, NRCS, Private Landowners, RPFs, County of Santa Cruz, Santa Cruz RCD, State Parks						0	On many roads, located on both public and private lands in the Aptos watershed, periodic maintenance occurs but does not address chronic, localized erosion problems. In these circumstances, the grading of poorly drained roads and repair of failed fills and stream crossings can lead to continued and even exacerbated rate of fine sediment delivery. Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment and runoff related problems and determine level of hydrologic connectivity.	3	10	CalFire, IWRP, NRCS, County of Santa Cruz, Santa Cruz RCD, State Parks	62.00	62.00				124	Initial assessment efforts should target Valencia Creek and lower mainstem Aptos Creek. Existing assessments should be used when possible. Excessive inputs of fine sediment in Aptos Creek watershed have compromised spawning and rearing habitat which directly impact the egg and adult lifestages. High instream sediment levels were identified as the most likely limiting factor to salmonids on both a watershed and individual reach scale (CWC and SHG 2003). Pool filling appears to have resulted from fine sediment transport from upslope sources with Valencia Creek having worse conditions than Aptos Creek. Roads are the largest contributor of chronic fine sediment into Aptos Creek (CWC and SHG 2003) although erosion from urban development (in the lower mainstem and Valencia Creek) and recreational trails are also a concern. Cost partially accounted for in SEDIMENT. Cost for road inventory estimated at $1,056/mile (assume 75% of road network).
ApC-CCCS-23.1.2.3	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	20	Private Landowners, County of Santa Cruz						TBD	Many road associations are inadequately funded. A road improvement fund for the Aptos watershed could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity.
ApC-CCCS-23.1.2.4	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	30	CalFire, CalTrans, NRCS, County of Santa Cruz, Santa Cruz RCD						TBD	Cost are likely accounted for with culvert replacement.
ApC-CCCS-23.1.2.5	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Private Landowners, County of Santa Cruz						TBD	Santa Cruz public works has been largely unsuccessful at finding spoils sites. A recent effort to locate potential sites in each major watershed failed to identify locations with willing landowners. Future efforts may require incentives to increase landowner participation.
ApC-CCCS-23.1.2.6	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, County of Santa Cruz						TBD	Roadside berms are common on many private and county roads in Santa Cruz County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails). Road inventory should identify roadside berms that are increasing runoff.
ApC-CCCS-23.1.2.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, NRCS, County of Santa Cruz						TBD	The road inventory should identify the number and type of energy dissipaters needed.
ApC-CCCS-23.1.2.8	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. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalTrans, FEMA, Private Landowners, County of Santa Cruz, State Parks						TBD	Cost difficult to determine but may result in a long term cost savings. Current economic conditions will likely delay implementation of this recommendation, if adopted.

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ApC-CCCS-23.1.2.9	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD, State Parks						0	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Action is considered In-Kind
ApC-CCCS-23.1.2.10	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, CalTrans, RWQCB, County of Santa Cruz, State Parks	35.00	35.00	35.00	35.00		140	Road densities are high throughout the watershed, estimated at 3.7 miles of road per square mile of watershed area and 4.6 miles per square mile of riparian area. Actual road densities may be even higher as this estimate does not include seasonal roads used for timber harvest. Many of these roads are poorly situated, constructed, and improperly maintained. Legacy roads from past logging activity, having been adopted as year-round roads and recreational trails, continue to impact the Aptos watershed. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed (CWC and SHG 2003). This recommendation will be difficult to implement due to the extensive development in the Aptos Creek watershed. Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards in areas with erodible geology and/or near high risk landslides rather than maintained and highly traveled surface roads. Targeted areas should include sub watersheds with high erosion potential (e.g., Valencia Creek). Roads in urbanized areas will be very difficult to decommission; roads in more remote areas, particularly those used for timber harvest will likely be much easier to target for decommissioning.
ApC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Design new roads to minimize the impact of unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, FEMA, IWRP, NRCS, State Parks						0	This recommendation should be considered standard practice. Action is considered In-Kind
ApC-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
ApC-CCCS-23.1.4.1	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	10	CalTrans, IWRP, County of Santa Cruz	1,700	1,700				3,400	According to CDFG (2004) cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. Cost based on providing passage (assume urban land use) at 2 total barriers at a rate of $1,124,448/unit and 2 partial barriers at a rate of $562,219/unit.

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ApC-CCCS-23.1.4.2	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	3	100	CalFire, CalTrans, FEMA, IWRP, NRCS, County of Santa Cruz, USACE						0	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001). Action is considered In-Kind
ApC-CCCS-23.1.4.3	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.	2	100	CalFire, CalTrans, County of Santa Cruz, USACE						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
ApC-CCCS-23.1.4.4	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.	3	50	CDFW, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure										
ApC-CCCS-23.1.5.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation types and species and promote desirable (native) vegetation.	3	100	CalFire, Private Landowners, County of Santa Cruz, State Parks						TBD	The road inventory should identify species and extent of removal of unwanted vegetation.
ApC-CCCS-23.1.5.2	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalTrans, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CalTrans, FEMA, Private Landowners, County of Santa Cruz, State Parks, USACE						0	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions. Action is considered In-Kind
ApC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ApC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, CalTrans, Private Landowners, County of Santa Cruz, State Parks						TBD	Road inventory cost accounted for in other recovery actions.
ApC-CCCS-23.2.2.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	Private Landowners, County of Santa Cruz, State Parks						0	Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-23.2.2.3	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	3	100	CalFire, PG&E, County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-23.2.2.4	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFW, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, County of Santa Cruz, USACE, USFWS						0	This should be considered a standard practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate. Action is considered In-Kind
ApC-CCCS-23.2.2.5	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	CalFire, Private Landowners, RPFs, RWQCB						0	Monitoring should occur throughout the periods between re-entry. Initial focus should occur in the highly erosive Valencia subwatershed. Action is considered In-Kind
ApC-CCCS-23.2.2.6	Action Step	Roads/Railroads	Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	County of Santa Cruz						0	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the Aptos Creek watershed and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils in Valencia Creek are some of the largest contributors to degraded streambed conditions in the watershed. Action is considered In-Kind
ApC-CCCS-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
ApC-CCCS-23.2.3.1	Action Step	Roads/Railroads	Amend County ordinances that discourage the use of inexpensive railcar bridges in favor of culverts.	3	25	County of Santa Cruz						0	Action is considered In-Kind
ApC-CCCS-23.2.3.2	Action Step	Roads/Railroads	Educate county policy staff and Board of Supervisors on the benefits of railcar bridges and provide information from other counties where they are commonly used.	3	10	Caltrans, County of Santa Cruz, NMFS						0	Action is considered In-Kind
ApC-CCCS-23.2.3.3	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	10	Caltrans, County of Santa Cruz, NMFS						0	Action is considered In-Kind
ApC-CCCS-23.2.3.4	Action Step	Roads/Railroads	Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	100	Caltrans, County of Santa Cruz, NMFS						0	Action is considered In-Kind
ApC-CCCS-23.2.3.5	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	10	CDFW						0	Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										
ApC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	CA Coastal Commission, FEMA, County of Santa Cruz, State Parks, USACE						0	Cost accounted for in estuary.
ApC-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	FEMA, County of Santa Cruz, Santa Cruz RCD, State Parks, USACE						0	Cost accounted for in ESTUARY.
ApC-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, County of Santa Cruz, Santa Cruz RCD, State Parks, USACE						0	Cost accounted for in ESTUARY.
ApC-CCCS-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-24.1.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions.	3	5	CDFW, IWRP, SWRCB	74.00					74	Many stream reaches in the Valencia watershed have water diversions and it is likely that downstream reaches experience impacts during the summer months. Cost for stream flow modeling estimated at $74,195/project.
ApC-CCCS-24.1.2.2	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFW, IWRP, SWRCB						0	Action is considered In-Kind
ApC-CCCS-24.1.2.3	Action Step	Severe Weather Patterns	Ensure all water diversions in the watershed are in compliance with all applicable laws and policies.	2	5	CDFW, NMFS, Private Landowners, RWQCB, County of Santa Cruz, SWRCB						0	The SWRCB should conduct periodic sweeps of diversions in Aptos Creek to ensure they are in compliance with annual reporting requirements and annual water usage is accurately reported. Action is considered In-Kind
ApC-CCCS-24.1.2.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	2	20	CDFW, NMFS, Private Landowners, RWQCB, County of Santa Cruz, SWRCB						TBD	Determine critical low flow levels and adopt protective measures to maintain viable rearing habitat for juveniles. Cost vary depending on landowner participation and feasibility of protective measures.
ApC-CCCS-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (impaired stream temperature)										

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-24.1.3.1	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	2	100	CDFW, NMFS, Private Landowners, RWQCB, County of Santa Cruz, SWRCB						TBD	Water temperatures during drought will likely be directly affected by ongoing surface water diversions in Aptos Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures.
ApC-CCCS-24.1.3.2	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	CDFW, NMFS, Private Landowners, RWQCB, County of Santa Cruz, SWRCB						0	Action is considered In-Kind
ApC-CCCS-24.1.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration										
ApC-CCCS-24.1.4.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	3	10	CDFW Law Enforcement, NMFS OLE						0	Action is considered In-Kind
ApC-CCCS-24.1.4.2	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could negatively impact steelhead.	3	15	CalFire, CalTrans, CDFW, NMFS, RWQCB, SWRCB						TBD	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
ApC-CCCS-24.2	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Coordinate protection measures and develop rules for augmenting water supplies and mitigating the effects of drought on fish.	2	100							0	Action is considered In-Kind
ApC-CCCS-24.2.1.2	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, which will minimize water-use conflicts and impacts on fish and wildlife resources during drought conditions.	2	100	CDFW, County of Santa Cruz, NMFS, SWRCB						0	Action is considered In-Kind
ApC-CCCS-24.2.1.3	Action Step	Severe Weather Patterns	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	20	County of Santa Cruz, SWRCB						0	Action is considered In-Kind
ApC-CCCS-24.2.1.4	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	2	100	CDFW, County of Santa Cruz, NMFS, SWRCB						0	Action is considered In-Kind
ApC-CCCS-24.2.1.5	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	25	CDFW, County of Santa Cruz, County Planning, DWR						TBD	Cost based on amount and type of conservation strategies needed.
ApC-CCCS-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of water quality conditions for rearing juvenile salmonids.	1	20	County of Santa Cruz, SWRCB						TBD	Cost accounted for stream flow modeling in SEVERE WEATHER PATTERNS.
ApC-CCCS-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-25.1.2.1	Action Step	Water Diversion/ Impoundment	Work with the County and SWRCB to ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	20	County of Santa Cruz, SWRCB						TBD	Cost for stream flow modeling already accounted for.
ApC-CCCS-25.1.2.2	Action Step	Water Diversion/ Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	2	10	CDFW, IWRP, County of Santa Cruz, SWRCB						TBD	Studies should include determining critical flow levels for stream reaches impacted by diversions, both current and future diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions would also be needed.
ApC-CCCS-25.1.2.3	Action Step	Water Diversion/ Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	2	30	CDFW, IWRP, County of Santa Cruz, SWRCB						0	Promoting action is considered In-Kind. Costs may be significant depending on site conditions and number of devices installed
ApC-CCCS-25.1.2.4	Action Step	Water Diversion/ Impoundment	Promote irrigation efficiency projects for agricultural uses in the watershed.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD						0	Action is considered In-Kind
ApC-CCCS-25.1.2.5	Action Step	Water Diversion/ Impoundment	Avoid and/or minimize the adverse effects of water diversion on CCC steelhead by establishing by-pass flows, season of diversion, and off-stream storage to create a more natural hydrograph.	3	5	CDFW	75.00					75	Cost based on establishing a stream flow/precipitation model first. Additional cost likely be encumbered for reduction in water diversions and restoring natural hydrograph. Cost for stream flow/precipitation model is estimated at $74,195/project.
ApC-CCCS-25.1.2.6	Action Step	Water Diversion/ Impoundment	Implement water conservation education programs.	3	20	CDFW, DWR						0	Action is considered In-Kind
ApC-CCCS-25.1.2.7	Action Step	Water Diversion/ Impoundment	Education programs should be directed at both municipal water users and those with riparian and appropriate water rights.	3	20	CDFW, County of Santa Cruz, DWR						0	Action is considered In-Kind
ApC-CCCS-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration										
ApC-CCCS-25.1.3.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of migration patterns for listed salmonids in Aptos Creek.	2	100	CDFW, IWRP, County of Santa Cruz, SWRCB						0	Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in Aptos lagoon by improving water quality. Costs cannot be estimated because the location of illegal diversions are not known, and the quantities of water diverted are unknown. The willingness of those diverting water to come into compliance with State Law is also unknown. Particular attention should be directed towards the large number of private wells in the Aptos groundwater basin. County of Santa Cruz estimates there are 250 private wells in the Aptos/Valencia watersheds. Action is considered In-Kind

Aptos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCCS-25.1.3.2	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFW, IWRP, County of Santa Cruz, SWRCB						0	This recommendation should be considered standard practice. Action is considered In-Kind
ApC-CCCS-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (impaired stream temperature)										
ApC-CCCS-25.1.4.1	Action Step	Water Diversion/ Impoundment	Prevent of minimize that the existing water diversions do not impair water temperatures in Aptos Creek.	2	100	CDFW, IWRP, County of Santa Cruz, SWRCB						0	As part of future streambed alteration, CDFW should require installation of temperature thermographs upstream and downstream of diversions. These results should be reviewed on a yearly basis by the SWRCB and CDFW. Action is considered In-Kind
ApC-CCCS-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ApC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	100	SWRCB						0	Action is considered In-Kind
ApC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Request the SWRCB conduct interagency consultation with the CDFW and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFW, NMFS, SWRCB						TBD	
ApC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Evaluate and monitor the streambed alteration compliance related to all water diversions (CDFG 2004).	2	5	CDFW, SWRCB						0	Action is considered In-Kind
ApC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Minimize new or increased summer diversions.	2	100	CDFW, SWRCB						0	Action is considered In-Kind
ApC-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Minimum instream flows should be established for salmonids and recommendations implemented for all water diversions.	3	10	CDFW, SWRCB						0	Cost accounted for in above action step.
ApC-CCCS-25.2.1.6	Action Step	Water Diversion/ Impoundment	Develop and enforce stream flow bypass requirements for diversions in the Aptos Creek watershed.	3	20	CDFW, CDFW Law Enforcement, DWR						0	Action is considered In-Kind
ApC-CCCS-25.2.1.7	Action Step	Water Diversion/ Impoundment	Evaluate all proposals for new or increased surface water diversions.	3	20	CDFW, SWRCB						0	Action is considered In-Kind
ApC-CCCS-25.2.1.8	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and coho salmon.	3	10	SWRCB						0	Action is considered In-Kind

Pescadero Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 2,200 adults
- Current Intrinsic Potential: 66.1 IP-km

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

Steelhead Abundance and Distribution

The Pescadero-Butano watershed is the second largest watershed in the Santa Cruz Mountains diversity stratum and it is the largest watershed in coastal San Mateo County. The watershed's two principal streams, Pescadero Creek and Butano Creek, which have their confluence in Pescadero Marsh, drain 81 square miles of the Santa Cruz Mountains. Historically, both creeks, as well as several tributary streams, supported runs of steelhead and coho salmon. Steelhead are still present, but there have only been sparse reports of coho salmon in the watershed in recent years. The 320-acre Pescadero estuary is important rearing habitat for steelhead. Summer rearing by steelhead in lagoons is potentially a major portion of watershed steelhead production (Smith 1990, Atkinson 2010, Bond *et. al.*, 2008).

Pescadero Creek was one of four "A-1" streams noted in San Mateo County in a 1912 California Department of Fish and Game (CDFG) letter and appears to have supported the largest steelhead run in the county historically (CDFG 1912, in Becker *et al*., 2010). In a 1967 report, the annual steelhead run of Pescadero Creek was estimated to consist of 1,500 spawning adults (CDFG 1967, *in* Becker *et al*., 2010). The system undoubtedly supported many more steelhead (and coho salmon) before any major degradation of the stream drainage began. For example, in 1870 a commercial fishery existed where a wagon load of steelhead and coho salmon, each weighing 1-14 kg, was taken daily from Pescadero Creek between October and March (Skinner 1962, *in* Titus *et al.*, 2010). It is reasonable to assume that the anadromous fish populations were previously larger than the 1967 estimate as evidenced by the presence of the commercial fishery in 1870 (Titus *et al*., 2010).

The modern chronicle charting the Pescadero steelhead population begins with early CDFG records. Surveys were conducted in 1962 in the upper creek (from headwaters to Portola State Park for a distance of 2.7 km) where juvenile steelhead and/or rainbow trout occurred in

visually estimated densities of 10-275 trout/30 m (average 110 trout/30 m) and were 2.5-18 cm long (average five cm). At that time, CDFG stocked catchable rainbow trout in the creek from Portola State Park to San Mateo County Memorial Park to support the summer trout fishery (Titus *et al*., 2011). There were suitable spawning areas for steelhead in the headwaters and from 0.8 km above Oil Creek to the State park on the mainstem. The remainder of this portion of the creek was heavily silted, and thus unsuitable for spawning. Rearing habitat, in the form of pools and shelter, was adequate for young salmonids.

In 1963, CDFG surveyed the lower most 17.5 km of the stream, from the mouth to Memorial Park. The uppermost 3.5 km of the survey area contained an estimated 3,479 square meters of suitable spawning grounds; much of the remaining 14 km of streambed in the survey area was heavily silted and contained only an estimated 1,254 square meters of utilizable spawning substrate for steelhead. The density of juvenile steelhead and/or rainbow trout was estimated at 300 trout/30 m in the upper 6.4 km of the survey area, and 100 trout/30 m in the 11.1 km below (overall average, 175 trout/30 m).

As in most California streams, fish production in Pescadero Creek was negatively impacted by the drought of water years 1975-76 and 1976-77. During the fall of 1986, the abundance of age 0+ and 1+ steelhead was determined at the fifth and sixth road crossings upstream from the mouth of Pescadero Creek. Density estimates based on two depletion estimates using electrofishing were 32.6 and 57.1 trout/30 m at bridge 5 and 6 respectively. In October 1987, trout densities were very similar to the year before: 28.0 and 64.0 trout/30 m (Titus *et al*., 2010). Pescadero Creek has been the object of "annual maintenance stockings" and the population may contain fish of mixed (i.e., wild/hatchery) origin (Becker *et al*., 2010).

Staff from CDFG surveyed Pescadero Creek in 1996 and observed multiple *O. mykiss* year classes, including YOY and individuals to about 10.5 inches in length (Becker *et al*., 2010). A watershed assessment noted abundant salmonid habitat, including areas of high quality habitat in the mid and upper Pescadero Creek watershed (ESA 2004). Staff from NMFS observed multiple *O. mykiss* year classes throughout a 13-mile section of Pescadero Creek in 2005, and in four locations in 2006 (Becker *et al*., 2010). Spawning steelhead were observed in the creek in April 2005 and March 2006 (Becker *et al*., 2010). During the winter and spring of 2011-12, Jankovitz (2012) observed 36 steelhead adults in 6 reaches, and redd densities ranged from 0 to 7.1 redds per kilometer. During the winter and spring of 2012-13, Jankovitz (2013) observed 152 steelhead in 3 reaches, and redd densities ranged from 13.9 to 32.4 redds per kilometer.

History of Land Use

The Pescadero area was occupied by several groups of native people (the Ohlone). The Ohlone maintained an open landscape by periodically burning the meadows in the lower watershed (ESA 2004). The first Spanish land expedition arrived in 1769 and the Ohlone were eventually recruited by the missionaries of Missions San Francisco and Santa Clara. In the 1830s, Mexican citizens requested land grants in the watershed. The Mexican era (1822-1848) was dominated by the granting of mission lands to private individuals and the importation of livestock into the watershed. There is also evidence of some early logging along Pescadero Creek upstream from the present-day town of Pescadero.

The period from 1848-1868 was dominated by the transfer of the Pescadero and Butano Ranchos into American hands and the efforts by the new owners to extract a living from the isolated valleys (ESA 2004). Early logging activities entered the two watersheds during this period; in 1859 there were two sawmills in the Pescadero watershed. Beginning in the 1850s, wheat, oats and barley were the dominant crops in the lower Pescadero watershed. Pescadero agriculture continued to diversify during the mid-1870s, and one of the major new crops was flax.

Because of its relative isolation, development in the watershed was slow through the 19th and early 20th centuries. During this period, most human activity was in the lowlands and coastal terraces, and consisted first of raising livestock and later row crop agriculture, limited production of timber products – mostly shingles – and tourism (ESA 2004). In the middle of the 20th century, the greatest change occurred. The period of 1930-1960 was a time of significant disturbance: Highway 1 and other major roads through the watershed were constructed or improved; most of the coniferous forests were clear cut; farming became increasingly mechanized and farmed land was extended up the coastal hills and on to previously uncleared lowland areas; Pescadero Marsh was diked and drained; and portions of the watershed were subdivided and developed as rural communities, vacation homes, and small ranches.

Current Resources and Land Management

The watershed is comprised of a mixture of private and public property. Timber production still occurs in the watershed and state and county parks in the watershed attract visitors. The lower Pescadero watershed supports a variety of agricultural crops.

The current level of disturbance is less than during the 1930-1960 periods; the rate of erosion appears to have decreased, and stream conditions are adequate to support salmonids in much of the watershed. Nevertheless, the effects of last century's disturbances are still apparent, and

current land management (e.g., timber production and agriculture) continues to have a lesser, but cumulatively significant adverse effect on stream resources.

Roadway construction produced additional encroachment on the stream and hydraulic function. Floodplain confinement at bridge crossings and where roads closely parallel the stream course are common problems and predicate more intrusive maintenance practices for infrastructure and property protection. These practices produce localized effects on hydrodynamic processes like sediment transport and erosion.

Several habitat enhancement actions have occurred throughout the watershed, including but not limited to, the partial implementation of the Pescadero Marsh Habitat Enhancement Plan in 1993 and removal or modification of fish passage barriers. Fish kills in the estuary have been reported in 10 of 15 years since 1995 in association with the annual breach and resource agency staff have met with other stakeholders to implement adaptive management actions (e.g., bladder dam installation) in the short-term to prevent the kills. Resource agency staff are also actively working with stakeholders in long-term restoration planning toward the goals of steelhead (and other listed species) recovery and eliminating the fish kill and increasing juvenile steelhead abundance, growth, and survival in the lagoon. The restoration vision is to return the Pescadero estuary ecosystem to a healthy, functioning state characterized by an extensive seasonal freshwater lagoon, marsh, and pond habitats during the summer and fall. In 2012, the NOAA Restoration Center, acting as the Federal lead and in collaboration with CDFG and local stakeholders, initiated a controlled breach of the sandbar to improve circulation in the lagoon. The effort was successful in that a fish kill did not occur for the first time in many years. While not a long-term recovery action, this effort should continue until the ultimate causes leading to degradation of the estuary are corrected.

Salmonid Viability and Watershed Conditions

The following habitat attributes were rated Poor through the CAP process: estuary, habitat complexity, sediment transport, and water quality. Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the upper 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 Pescadero CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Estuary: Quality & Extent

The 320 acre Pescadero marsh/estuary/lagoon has been reduced in size following European arrival; nonetheless, it is relatively intact in areal extent when compared to many other major estuaries in the Santa Cruz Mountains Diversity Stratum. Summer rearing by steelhead in lagoons, such as Pescadero, is potentially a major portion of steelhead production in the watershed (Smith 1990; Atkinson 2010; Bond *et. al.,* 2008). While the Pescadero estuary was extensively converted for agricultural purposes, it also has relatively little permanent infrastructure (hard-scape) within the historical tidal prism (which increases the feasibility of large scale restoration efforts). However, the estuary is significantly impaired due to a variety of anthropogenic alterations which affect the overall hydrology, water quality, and water chemistry.

The mouth of Pescadero watershed was historically an open-estuary during the winter/spring, and during the summer/fall of non-drought years, it was typically a closed de-stratified, freshwater lagoon that provided important rearing habitat for steelhead (Williams 1990; Smith, 1990). During the winter and spring in Pescadero Creek lagoon, Smith (1990) documented juvenile steelhead growth increased when the mouth was fully open and subject to tidal action. Smith (1990) further reported during the summer and fall, juvenile steelhead growth increased after the water column de-stratified and fully converted to freshwater which improved water quality conditions (increased dissolved oxygen concentrations and reduced temperature) throughout the water column. Additionally, Smith (1990) found steelhead growth in the lagoon was substantially greater than in the stream habitat, and steelhead rearing in the lagoon were substantially more likely to return as adults. The importance of lagoon-rearing for smolt-to-adult steelhead survival has been shown extensively in steelhead studies in other Central California Coastal lagoons (Shapovalov and Taft, 1954; Smith, 1990; Bond, 2006; Hayes *et al.,* 2008; Hanson, 2008; Atkinson, 2010), even when conditions are only marginally suitable. Other studies at Pescadero Lagoon showed that there was a relationship between salinity de-stratification (and water quality conditions) and macro invertebrate abundance (Robinson, 1993) as well as with food habits (Martin, 1995).

Changes to the steelhead population and water quality were documented following replacement of Highway One Bridge in 1991 and implementation of the Pescadero Marsh Natural Preserve Hydrological Enhancement Plan in 1993. Since construction of these projects the system no longer converts to a seasonal freshwater lagoon because the sandbar forms two to three months later than it did prior to 1993 (in the early fall rather than in the late spring/early

summer). The delay in sandbar closure does not allow adequate time for available streamflow to de-stratify the water column and fully convert it to freshwater (Smith and Reis 1997; Smith 2010). Water quality (dissolved oxygen concentrations and temperature) has degraded since the 1990s and fish kills have been reported for at least 15 of 19 years (Smith and Reis 1997; Sloan 2006; Smith 2009, Huber 2014). Sloan (2006) reported salinity-stratification explained anoxic conditions after the annual breach and attributed this as the causative mechanism behind the fish kills. Smith (2009) reported low dissolved oxygen concentrations in the lower saline layer of the salinity-stratified water column chemically-reduces sedimentous iron and sulfur compounds and the chemical oxygen demand of that sediment re-suspension likely causes rapid oxygen depletion after the sandbar breach. Smith (2007; 2008) reported a significant decline in steelhead abundance from the 1980s and asserted the decline occurred after the implementation of the Hydrological Enhancement Plan work and replacement of the State Route 1 Bridge, briefly described below.

Recent anthropogenic modifications in the marsh are generally believed to have altered estuary/lagoon function. US Route 1 construction included modification of the stream and estuary / lagoon outlet with spits to confine the crossing to a single bridge configuration. In 1991, California Department of Transportation (Caltrans) replaced the original State Route 1 Bridge. The old design included four abutments within the estuary/lagoon mouth and the new bridge was more open-span, consisting of two bridge abutments.

In 1993, California Department of Parks and Recreation implemented restoration actions in its "Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990)" to increase and isolate hydrologic connectivity between areas within the estuary/lagoon/marsh complex. The stated goals were to protect habitat for sensitive species, provide flood control, and reduce sediment within the estuary/lagoon/marsh. In the southern portion of the Marsh, restoration actions included widening the lower portion of Butano Creek and removing portions of levees across various areas in the Marsh. In the northern portion of the Marsh, restoration actions included widening and excavating a channel connecting Pescadero Creek with North Pond, excavating a channel, and building a levee with eight gated-culverts that crossed the channel in close proximity to its confluence with Pescadero Creek. The gated culverts were to be manually closed when the sandbar formed to facilitate freshwater conversion. The purpose of these culverts was to enhance and protect rearing habitat for steelhead (rapid freshwater conversion provides improved water quality conditions) as well as to provide habitat for other sensitive species (California red legged frog, San Francisco garter snake, tidewater goby, and Western pond turtle). Additionally, a "low elevation levee" was built separating North Pond and North Marsh for the purpose of isolating North Marsh from

tidal influence to protect and enhance sensitive species (California red legged frog, San Francisco garter snake, and tidewater goby) habitat.

Unfortunately, the Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990) was not implemented according to the intended hydrological and biological goals. The low elevation levee was constructed too low and the culverts quickly rusted and became inoperable (Smith and Reis 1997). By 1995, the sandbar began forming substantially later in the year and this continues to present day (Smith and Reis 1997; Smith 2009). Currently, there is not enough time for reduced late summer stream flow to fully convert the water column to a freshwater lagoon and as a result the water quality in the lagoon is impaired (*e.g.*, stratified, with anoxia in the bottom layers). Tidewater now over-tops the "low elevation levee" which has changed the designed freshwater habitat for sensitive species (other than steelhead) to unsuitable saltwater conditions. Smith (1990) documented that steelhead juveniles grew very rapidly in Pescadero lagoon in non-drought years prior to implementation of the two aforementioned projects in the 1990s. Benefits of the lagoon to listed salmonids are compromised when conditions, as described above, occur. The impaired condition of the lagoon is one of the most significant limiting factors to the steelhead population in the Pescadero Creek watershed.

Sediment Transport: Road Density

High levels of instream fine sediment likely impair steelhead spawning and rearing success within the Pescadero Watershed. ESA (2004) estimated total sediment delivery rates and yield from upslope sources into the channels of Pescadero Creek during three time periods, 1937-1956, 1957-1982, and 1983-2002. From 1937-1956, the delivery rate was estimated at 245,500 yds^3/year. From 1957-1982 the delivery rate was estimated at 81,759 yds^3/year, while from 1982-2002 the delivery rate was estimated at 97,511 yds^3/year. Sources that contributed to the altered sediment transport include agriculture, grazing, roads, and logging.

Water Quality: Turbidity or Toxicity

Water quality is impaired from land use practices in the watershed. Many land-use practices degrade water quality and steelhead survival, principally through the input of fine sediment which results in increased turbidity, smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and inadequate road maintenance practices, agriculture, residential development, and logging. The variable geology of the watershed lends stream reaches in the lower watershed, including Butano Creek, more susceptible to elevated levels of turbidity.

Habitat Complexity: Large Wood and Shelter

Habitat inventories indicate LWD is likely less abundant than prior to European settlement, due primarily to logging activities and stream management that included LWD removal over the past century (ESA 2004). Poor LWD ratings were documented for most of the 23 sample reaches evaluated by ESA (2004) within the watershed. ESA (2004) noted a high proportion of recently recruited LWD and low proportion of decayed wood in the channel compared to a similar inventory on the Garcia River in Mendocino County, California (which, like Pescadero Creek, is dominated by redwood forest). The small proportion of decayed pieces in the Pescadero-Butano water is indicative of instream wood removal. ESA (2004) also noted that over half the conifer recruitment observed in their 23 sample reaches occurred in just two reaches located in Portola Redwoods State Park, suggesting the relatively mature forest stands in the park generate a high proportion of LWD recruited to the channels, and an inherently higher degree of protection of these attributes likely occurs due to government ownership. The paucity of LWD in areas outside the park likely is the major contributor to the lower shelter values estimated in the watershed (an average rating of 20 out of a possible total of shelter rating of 300).

Threats

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

Agriculture

Approximately 1,440 acres (about three percent of the watershed), primarily located in the floodplain, are cultivated for agriculture. Topsoil eroded from the farmed areas by sheet erosion is transported into Pescadero Creek. The most current data (1983-2002) on the delivery rate of sediment (8,828 yrd^3 per year) attributable to agriculture (and grazing) shows a reduction from historical levels as estimated by ESA (2004) for the 1937-1956 (104,926 yrd^3 per year) time period. However, the current levels of sediment delivery are elevated from the 1957-1982 time period when sediment delivery rate had dropped down to 1,588 yrd^3 per year. High sediment yields can be partially attributed to flax production on the highly erosive hillsides in the lower watershed, which led to extensive gullying and sediment delivery to stream channels. Conditions leading to higher sediment yields in the more recent past as compared to the 1957-1982 time period is unknown. One reason may be due to the location of some of the agricultural practices in the watershed. In some areas agriculture is practiced adjacent to the lower mainstem of Pescadero and Butano Creeks Creek where riparian buffers are limited in quality and lineal extent. In these areas, sediment contribution is likely high due to the small

riparian buffers and highly erosive geology in the area. Agricultural practices may also degrade water quality in the creek by introducing various herbicides and pesticides into the waterway.

Channel Modification

Channel modification was determined to be a High threat in large part due to the extensive modifications to the hydrology of the Pescadero-Butano Marsh. When Europeans arrived, the estuary was modified to facilitate farming of the rich bottom lands. One of the first procedures to reclaim the wetlands was development of a series of drainage ditches to drain off water (Green Foothills 2002). This was followed by land leveling and filling in depressions, old stream channels, or other places where water would collect. Eventually, levees were constructed that confined Butano and Pescadero into defined channels to facilitate farming (Green Foothills 2002). Water control devices were installed in the levee system to act as a drain and prevent salt or brackish water from backing up and inundating farmland. In 1993, the USFWS funded a restoration project to enhance the hydrology of the estuary based on the recommendations in the Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990). Unfortunately, the project was not constructed as designed, and the culvert system that was integral to managing the hydrology of the estuary was not properly operated or maintained by State Parks (Smith and Reis 1997). Furthermore, the terms and conditions of the USFWS biological opinion were not followed (Cordova pers. comm. 2011). As a result, this well-intentioned project has fallen into a state of disrepair. Since the tide gates on the culverts are no longer functional, they are believed to exacerbate degraded water quality conditions in the estuary/lagoon. The hydrologic alterations resulting from past channel modifications have been the subject of extended conversations between numerous interested stakeholders over a number of years. To date, little action resulting in tangible measures has occurred to address the adverse impacts resulting from these modifications despite ongoing impacts to the steelhead fishery, which have included numerous fish kills during the late fall.

Fire and Fuel Management

Some areas in the Pescadero watershed have a high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher stream temperatures, which are already above optimal condition along the mainstem, would likely result.

Logging and Wood Harvesting

Timber harvest remains a threat to steelhead habitat in Pescadero Creek, but to a lesser degree when compared to historical practices. Timber harvest was listed as a threat for the winter

rearing lifestage due to potential increases in turbidity during the wet weather period and the potential for lost trees that could be recruited into the wetted channel if they were not harvested. A lack of wood recruitment would ultimately limit the extent of high water refugia in a watershed where LWD and refugia habitat are already limiting.

Residential and Commercial Development

The 2010 census estimated the population within Pescadero Creek at 1,795 individuals. Three percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2015), with the majority of the development located in the lower portion of the watershed in the community of Pescadero or along the mainstem of Pescadero Creek. Although the population in the watershed is relatively low compared to many other watersheds in the DPS, the proximity of residences to stream channels and the community of Pescadero to the estuary likely place riparian areas and stream channel at greater risk for future alterations. The community of Pescadero is prone to flooding, and efforts to minimize the impacts of flooding will likely include removal of instream habitat features such as wood debris (this is a practice that has occurred in the past). Residences located adjacent to stream channels are often at increased risk of bank erosion, and efforts to protect existing infrastructure will likely include bank stabilization efforts that would further degrade salmonid habitat.

Roads

Road densities are high throughout the watershed, estimated at 2.7 miles of road per square mile of watershed area, and at 3.2 miles per square mile of riparian area. Many of these roads are poorly situated and constructed, and improperly maintained. Roads were rated as accounting for the largest percentage of total sediment delivery in the watershed from 1983-2002 by ESA (2004). The total road-related sediment delivery rate during this time period was estimated at 50,379 yards^3 per year, which is more than twice the combined sediment delivery of all other land use in the watershed. Annual sediment delivery volumes associated with roads show only a slight decrease through three time periods evaluated by ESA (2004): 1937-1956, 1957-1982, and 1983-2002. ESA (2004) noted that while construction and maintenance practices are steadily improving, there are many miles of unused and/or abandoned secondary roads on both public and private lands that have not been properly upgraded or decommissioned commensurate with the decrease in management intensity in the basin. Many of these roads may be poorly designed with regard to drainage (ESA 2004). Even though chronic fine sediment production decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to many forms of erosion, including culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (ESA 2004). On many forest and ranch roads located on both public and private lands, periodic maintenance occurs in the absence of an attempt to

address chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossing can continue sediment delivery. Additionally, paved and unpaved roads parallel many of the waterways within Pescadero Creek and impinge on channel migration.

Severe Weather Patterns

Extreme flood events such as occurred in 1955 could result in major input of sediment from upslope locations. Much of the watershed is comprised of highly erodible geology which would likely impact spawning and rearing habitats when sediment enters the stream channel. Improvements in land use practices will likely lower sediment yield rates following future flooding events.

Water Diversion and Impoundment

Aquatic conditions in Pescadero Creek are adversely affected by water diversions. The watershed has been designated as a fully appropriated stream by the California State Water Resources Control Board. Water diversions adversely impact the summer lifestage by reducing flows and available habitat for rearing and feeding in the riverine areas as well as the estuary. Water diversions also extend the duration necessary for conversion to a freshwater lagoon during the summer. The greatest numbers of water diversions are located in the lower watershed and in Butano Creek. Diversion in Butano Creek and its tributaries, coupled with degraded instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer and winter lifestages are likely most limiting steelhead productivity in the Pescadero Creek watershed. Water quantity and quality are likely inadequate for properly functioning estuarine conditions. The inadequate quantity is largely a result of direct water diversions adversely affecting rearing habitat quality in the estuary during summer through late fall.

General Recovery Strategy

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

Restore Pescadero Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Public Resources Code 5019.71 states, in relevant part, "Areas set aside as natural preserves shall be of sufficient size to allow, where possible, the natural dynamics of ecological interaction to continue without interference, and to provide, in all cases, a practicable management unit. Habitat manipulation shall be permitted only in those areas found by scientific analysis to require manipulation to preserve the species or associations that constitute the basis for the establishment of the natural preserve." Due to past alterations, it may be impractical to restore Pescadero Marsh to a completely unmanaged ecosystem. Therefore, although restoration alternatives requiring minimal management are preferred, active management may be necessary to maximize steelhead production and minimize fish kills. State Parks' policy is to manage the Pescadero Marsh Natural Preserve as a natural system, but ecological processes in the estuary and the watershed are not at properly functioning condition. Addressing limiting factors to restore conditions in the estuary will benefit the steelhead production in the entire watershed and the steelhead population in the Santa Cruz Mountains diversity stratum.

The goals of restoration should be to return the Pescadero estuary ecosystem to a healthy, functioning state characterized by an extensive seasonal freshwater lagoon, marsh, and pond habitats during the summer and fall to facilitate recovery. Objectives leading to steelhead recovery include eliminating annual fish kills associated with unauthorized and uncontrolled breaching events prior to the onset of wet weather conditions and increasing juvenile steelhead abundance, growth, and survival. Restoration actions should address stressors, including the proper timing of sandbar formation to allow for adult in-migration, smolt out-migration, as well as returning the system to a seasonal freshwater lagoon for juvenile rearing. In addition, the following issues will need to be resolved: water quality, quantity, breaching, habitat availability, capacity, and suitability. Efforts should focus on the ultimate causes of impairment as well as the proximate issues limiting current habitat suitability.

Significant controversy and uncertainty exist between local interest groups, scientists, resource agencies and local land owners regarding restoration of the estuary. This controversy has prevented implementation of most projects designed to restore estuarine/lagoon conditions and has recently led to filing of at least one lawsuit against State Parks and CDFW. Initiation of restorative actions to return the system to a seasonal freshwater lagoon is critical, and efforts should include a willingness to accept a degree of uncertainty and acceptance of an adaptive management approach. Efforts should include hypothesis testing and peer review of restoration actions that provide a feedback loop for future adjustments and future actions. All efforts should include monitoring (timing of sandbar closure, lagoon water quality, and lagoon

fish growth and abundance) to determine whether the intended function of a restoration action is ultimately met.

While it is important to recognize the link between processes in the lagoon with those upstream, initial focus should be placed primarily on lagoon processes to ensure restoration actions are implemented in a timely manner. Sea level rise may, in the future, have impacts to steelhead in the estuary/lagoon, and at this time, it is unknown how or to what degree impacts may occur. An important component in conservation biology includes timeline, and we believe it is critical to improve steelhead habitat function and populations in the short-term so as to maximize their resilience to a changing environment. It is likely the Pescadero estuary, unlike many degraded California estuaries, could be restored to its biological potential through a focused and comprehensive effort in a relatively short period of time. However, developing and repairing partnerships between the resources agencies and the local community will likely be essential to accomplishing this task in timely fashion.

Minimize Diversions and Diversion Effects

Diversions from direct diversions and possibly from near stream wells likely impact the summer rearing lifestage in the lower watershed, and summer and fall rearing in the estuary. The diversions likely impact water circulation and thermal regimes when the estuary closes, which reduces available rearing habitat and places rearing salmonids at greater risk when the sandbar prematurely breeches. Water diversions reduce the quantity of water in the wetted stream channel, and increase diurnal temperature fluctuations and reduce available rearing habitat. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions. Initial focus to minimize the adverse effects of diversions should be directed at the Butano Creek watershed. Additional practices could include developing off-channel storage facilities to divert water during the winter high flow period in exchange for leaving water instream during the summer low flow period. Efforts to coordinate diversion timing and sharing of water through conjunctive use agreements could also be developed to minimize impacts.

Improve Instream Habitat Quality and Quantity

Returning riparian corridors to properly functioning condition alone is unlikely to solve the poor instream habitat conditions prevalent throughout much of the watershed. While improved riparian function will increase wood recruitment into streams, further restoration measures will be required to fix the current poor condition of instream habitat. Recovery actions should focus on improving spawning habitat through placement of standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly sized trees could be

felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a common problem throughout the watershed but are more severe in the lower portion of Pescadero and Butano due to the parent geology of Pescadero Creek. Past land uses (such as post-World War II logging and agriculture) in these areas have contributed to the filling-in of Butano Creek and Pescadero Marsh (Williams 1990). Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites that will provide immediate biological benefits to steelhead rearing and spawning should receive initial restoration funding.

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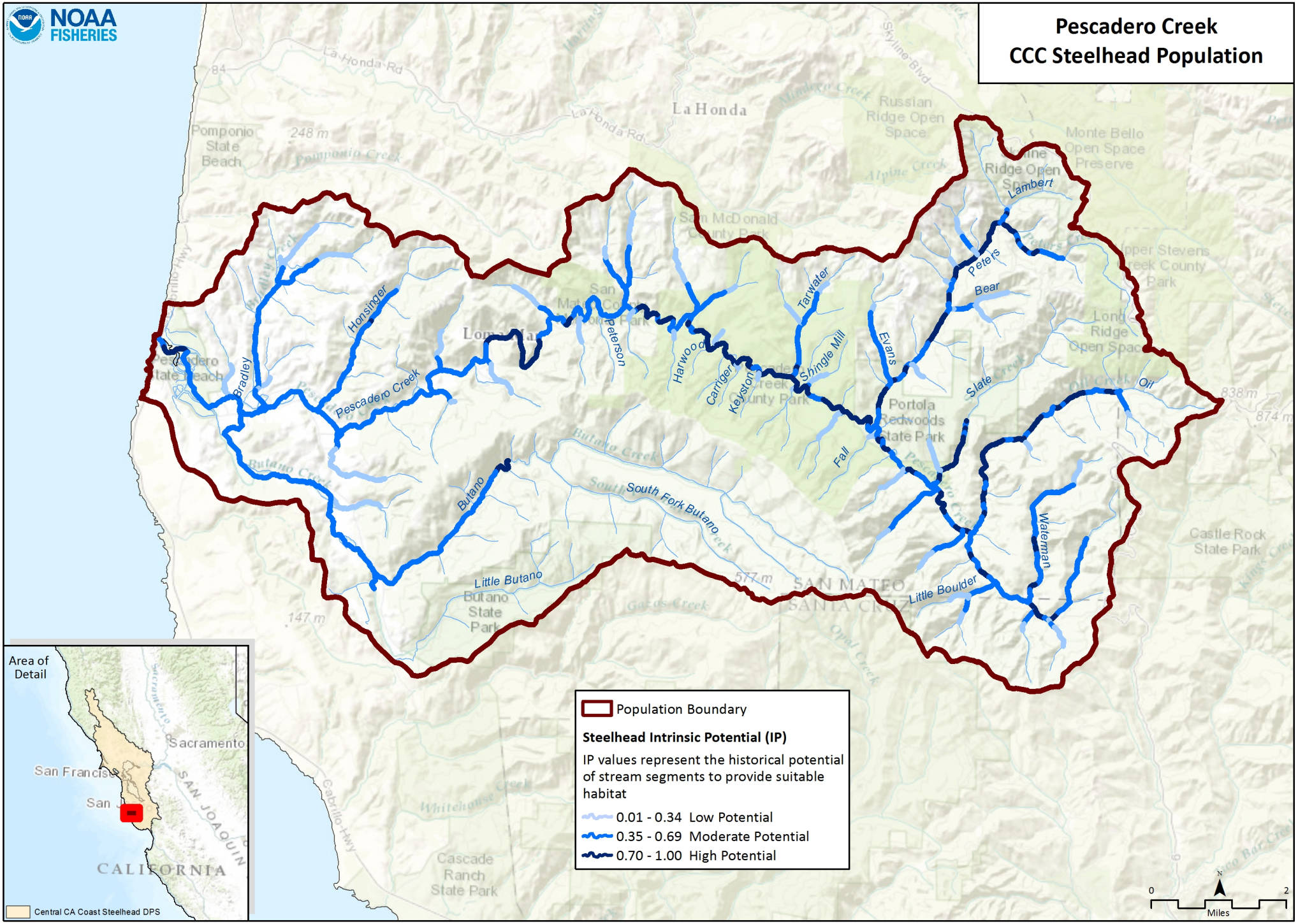
Pescadero Creek
CCC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Sacramento
San Francisco
San
CALIFORNIA
Central CA Coast Steelhead DPS
Pescadero Creek
Bradley
Honsinger
Peterson
Harwood
Carriger
Keyston
Tarwater
Shingle Mill
Evans
Fall
Lambert
Peters
Bear
Slate
Oil
Waterman
Little Boulder
Butano
Little Butano
South Fork Butano
La Honda
Pomponio State Beach
Pescadero State Beach
Butano State Park
Portola Redwoods State Park
Castle Rock State Park
Cascade Ranch State Park
Russian Ridge Open Space
Monte Bello Open Space Preserve
Long Ridge Open Space
Upper Stevens Creek County Park
San Mateo County
Santa Cruz
0
2
Miles

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% 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)	80% streams/ 85% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	20% streams/ 15% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	78.3% 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		
			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	?80% Density rating "D" across IP-km	Good

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		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 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	100% streams /100% IP-km (>50% stream average scores of 1 & 2)	Very Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	0% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	80% streams/ 85% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	20% streams/ 15% 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 35-50	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	4.92 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	78.3% of IP-km	Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	100% streams /100% IP-km (>50% stream average scores of 1 & 2)	Very Good
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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	>90% of Historical Range	Very Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	80% streams/ 85% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			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	78.3% 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		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	100% streams /100% IP-km (>50% stream average scores of 1 & 2)	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	20% streams/ 15% 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	4.92 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)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.25% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	1.47 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	11% 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	3% 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	2.7 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	3.2 Miles/Square Mile	Poor

Pescadero Creek CAP Threat Results

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

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat										
PeC-CCCS-1.1.1.1	Action Step	Estuary	Assess the benefits of altering existing dikes and levees which currently reduce shoreline complexity and natural function	3	10	CDFW, Farm Bureau, NMFS, San Mateo County, State Parks, USFWS	2,109	2,109				4,217	Implementing effective restoration actions in the Pescadero estuary is considered essential due to the relative importance of estuaries on the Central Coast for salmonid rearing. Over the past 150 years, diking, channelization, reclamation, and excessive sedimentation have dramatically altered the size and character of the 320 acre Pescadero estuary. Some of these past modifications have impacted the estuary's overall hydrology and water chemistry. Still, the overall areal extent of the estuary remains relatively intact and there is relatively little permanent infrastructure (hard-scape) within the estuary which increases the feasibility of large scale restoration efforts. Removal or reconfiguration of levees could help initiate restoration of natural estuarine functions. NMFS (2008) estimated floodplain and tributary reconnection could range in cost from $8,721 to $81,395 per acre. Costs in Pescadero Marsh would likely be at the higher edge of that estimate range. If side channel restoration is proposed NMFS (2008) estimated cost could range between $34,884 and $290,698 per acre. CEMAR (2010) discussed a number of potential restoration actions that could include (1) lowering the right bank levee of Pescadero Creek at the upper end of the Marsh, (2) Raising or repairing the low levee along the channel adjacent to North Marsh that leads to North Pond, and (3) Remove some or all of the remaining levees between Butano Creek and Butano Marsh. Cost based on treating 15 acres assume 5% of current estuarine extent) at a rate of $281,099/acre.
PeC-CCCS-1.1.1.2	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	5	CDFW, NMFS, SWRCB						0	Work would entail SWRCB reviewing all existing water diversions and contacting diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to come into compliance which is reflected in the tentative cost estimate. Action is considered In-Kind
PeC-CCCS-1.1.2	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-1.1.2.1	Action Step	Estuary	Encourage USFWS to reinitiate consultation for biological opinion with State Parks regarding the estuary restoration project because their biological opinion was not fully implemented by State Parks.	3	3	State Parks, USACE, USFWS						0	In 1993, California Department of Parks and Recreation implemented restoration actions as part of the "Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990)" to both increase as well as isolate hydrologic connectivity between areas within the estuary/lagoon/marsh complex. The stated goals were to protect habitat for sensitive species, provide flood control, and reduce sediment within the estuary/lagoon/marsh. The gated culverts were to be manually closed when the sandbar formed to facilitate freshwater conversion. The purpose of these culverts was to enhance and protect rearing habitat for steelhead (rapid freshwater conversion provides improved water quality conditions) as well as to provide habitat for other sensitive species. Unfortunately, Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990) was not implemented according to the intended hydrological and biological goals: the low elevation levee was constructed too low and the culverts quickly rusted and became inoperable (Smith and Reis 1997). Currently, there is not enough time to fully convert the water column to a freshwater lagoon and the water quality is impaired. Tidewater now over-tops the "low elevation levee" which has changed the designed freshwater habitat for sensitive species (other than steelhead) to unsuitable saltwater conditions. The impaired condition of the lagoon is one of the most significant limiting factors to the steelhead population in the Pescadero Creek watershed and could limit steelhead when populations are re-established in the watershed. This project was completed before steelhead were ESA listed. Action is considered In-Kind
PeC-CCCS-1.1.2.2	Action Step	Estuary	Evaluate all floodgates and levee breaches within the tidal portion of Pescadero Creek and develop actions for these sites that will lead to improved water quality including a rapid conversion to a freshwater lagoon following sandbar closure.	2	3	State Parks, USFWS						0	Cost accounted for in increase the extent of estuarine habitat.
PeC-CCCS-1.1.3	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
PeC-CCCS-1.1.3.1	Action Step	Estuary	Restore the timing of sandbar closure so that it closes in June / July- so as to provide adequate time for de-stratification and conversion to freshwater.	3	3	CA Coastal Commission, CalTrans, CDFW, NMFS, Public, RWQCB, State Parks, USACE, USFWS	93.00					93	Changes to the steelhead population and water quality were documented following replacement of Highway One Bridge in 1991 and implementation of the Pescadero Marsh Natural Preserve Hydrological Enhancement Plan in 1993. Since construction of these project the system no longer converts to a seasonal freshwater lagoon because the sandbar forms two to three months later than it did prior to the 1993 (in the early fall rather than in the late spring / early summer). Early closure is believed necessary to prevent fish kills and maximize lagoon productivity. Three years of experimentation should be adequate to ascertain whether this action produces favorable results in regard to frequent fish kills that many believe adversely affect the steelhead population rearing in the closed lagoon. If this experiment results in desired results it should be incorporated into ongoing Pescadero operations by State Parks during most water years. This action has a potential to produce significant benefits to rearing steelhead by precluding fish kills and maximizing water quality benefits. Permitting requirements should be closely coordinated between all responsible agencies by a well-qualified and experienced permitting lead with a track record of success on challenging projects. CCC steelhead are directly impacted by these conditions. Cost based on treating 15 acres (assume 5% of total estuarine habitat) at a rate of $6,198/acre. Cost can be vary widely depending on various experimental approaches to sandbar closure.
PeC-CCCS-1.1.4	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-1.1.4.1	Action Step	Estuary	Implement restoration actions that benefit listed salmonids and other special status species in the estuary. Requirements and goals will vary by species.	2	10	CalTrans, CDFW, Farm Bureau, NMFS, Private Landowners, RWQCB, San Mateo County, State Parks, USACE, USFWS						0	Efforts should be guided by appropriate protection and enhancement guidelines. Restoration should include immediate actions as well as long term actions to address systemic problems in the estuary with the primary goal of restoroing processes that facilitate water column destratification and conversion to freshwater during the dry season. Short term actions could include measures from CEMAR's Dec. 9, 2010, and Smith and Reis (1997) list of potential restoration actions. All actions should include a monitoring component so the impacts of the actions are well understood by all parties interested in the Pescadero Marsh. CEMAR (2010) discussed a number of potential restoration actions that could include (1) lowering the right bank levee of Pescadero Creek at the upper end of the Marsh, (2) Raising or repairing the low levee along the channel adjacent to North Marsh that leads to North Pond, and (3) Remove some or all of the remaining levees between Butano Creek and Butano Marsh. Other options are likely also viable and should be explored. Cost accounted for in other recovery actions.
PeC-CCCS-1.1.5	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										
PeC-CCCS-1.1.5.1	Action Step	Estuary	Evaluate existing conservation easements in the Estuary to ensure they are in conformance with original terms and conditions of the easement.	3	5	Landtrust, Private Landowners, State Parks						0	This cost should be minimal and should be considered a standard business practice by the entity that has granted conservation easements for private properties in the estuary.
PeC-CCCS-1.1.5.2	Action Step	Estuary	Minimize construction of new buildings and associated infrastructure in the historical estuary tidal prism.	I	100	CalTrans, FEMA, San Mateo County, State Parks, USACE						0	New infrastructure should be constructed above the historical tidal prism. Although a large portion of the tidal prism has been reclaimed for agriculture it is conceivable some of these farmed areas could be restored and provide important water quality and ecological benefits to the estuary. Development of permanent infrastructure in these areas usually precludes future ecologically beneficial restoration and typically results in additional chronic degradation due to flood prevention measures, and other similar actions, into the future. Action is considered In-Kind
PeC-CCCS-1.1.6	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
PeC-CCCS-1.1.6.1	Action Step	Estuary	Implement patrols by citizens groups, State Parks, and law enforcement to ensure the sandbar is not illegally breached.	2	100	CDFW Law Enforcement, NMFS OLE, Pescadero Municipal Advisory Council, Public, State Parks						TBD	Rough cost estimate for the 100 year period. Close coordination by all parties would likely comprise the majority of the costs. Other methods should also be evaluated such as installation of cameras that provide real time oversight. Cost of recovery action are expected to be minimal due to volunteer patrols.
PeC-CCCS-1.1.6.2	Action Step	Estuary	Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Pescadero Creek lagoon.	2	100	CDFW Law Enforcement, NMFS OLE, State Parks						TBD	Financial rewards may act as a deterrent to those involved in the unauthorized breaching of the lagoon. The lagoon has a long history of illegal breaches and to date no one has been successfully prosecuted for this activity. Breaching is believed to result in significant adverse impacts to steelhead rearing in the lagoon. Breaching has historically coincided with the start of the December steelhead fishing season in Pescadero Creek.
PeC-CCCS-1.1.6.3	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	CDFW, State Parks	1.50	1.50				3	Cost of signage varies widely depending on materials and information. Assume standard rate of $1,000/sign.
PeC-CCCS-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	20	CDFW, NMFS, NRCS, San Mateo County, San Mateo RCD, State Parks						TBD	The number of projects will vary depending on landowner participation and acceptance. Assume standard rate of $$42,408/acre.
PeC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CDFW, FEMA, RWQCB, San Mateo County, USACE						0	This recommendation should be considered standard practice.
PeC-CCCS-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
PeC-CCCS-3.1.1.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	1	20	CDFW, IWRP, POST, Private Landowners, SWRCB						TBD	The price at which water is sold on environmental water markets is determined by negotiations between landowners and purchasing entities. The aggregate fiscal cost of water acquisition will depend on the quantity of water acquired and whether water rights will be permanently transferred or purchased for single periods of time. Initial efforts should be directed at water diversions in the Butano watershed.
PeC-CCCS-3.1.1.2	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	100	CDFW, Farm Bureau, IWRP, NOAA RC, NRCS, POST, Private Landowners, San Mateo County, San Mateo RCD, State Parks, SWRCB, Trout Unlimited						TBD	Water augmentation costs were estimated in regards to the Shasta-Scott Pilot Program (CDFG 2004). These results indicated potentially significant costs. Off channel storage cost will vary depending on landowner participation, regulatory agency participation, and permitting requirements.
PeC-CCCS-3.1.1.3	Action Step	Hydrology	Develop more efficient and coordinated use of water resources to provide increased supply, restore groundwater levels, and increase dry weather baseflows through conjunctive management, use of reclaimed wastewater, and increased storage or utilization of excess winter stream flows.	2	100	CDFW, IWRP, NRCS, POST, San Mateo RCD, SWRCB						TBD	Costs will vary depending on landowner participation.
PeC-CCCS-3.1.1.4	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	2	20	Farm Bureau, Laguna Foundation, NRCS, POST, San Mateo RCD						0	Initial focus should be directed towards agricultural practices in the Butano sub-watershed.
PeC-CCCS-3.1.2	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
PeC-CCCS-3.1.2.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707.	1	10	CDFW, Farm Bureau, San Mateo County						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-3.1.2.2	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead.	2	10	CDFW, County of San Mateo, Mid Peninsula Open Space District, NMFS, Private Landowners, San Mateo County RCD	37.10	37.10				74	Cost for stream flow monitoring estimated at $74,195/project.
PeC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
PeC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Encourage retention of large woody material for all historical steelhead streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	Big Creek Lumber Co., CalFire, CalTrans, CDFW, FEMA, NMFS, NRCS, Pescadero Municipal Advisory Council, POST, Private Landowners, Red Tree, RWQCB, San Mateo County, San Mateo RCD, USACE						0	This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations funding restoration projects. Manipulation of LWD should not occur until evaluated by the County of San Mateo Planning staff and hydrologist and/or qualified biologist familiar with Central Coast streams. LWD target could likely be achieved in a relatively short time period of existing if naturally recruited large wood was left intact by landowners. Cost savings would be significant. Currently a significant amount of large woody material in removed without proper authorization in the Pescadero Creek. Poor LWD ratings were documented for most of the 23 sample reaches evaluated by ESA et al. (2004) within the watershed. ESA et al. (2004) noted a high proportion of recently recruited LWD and low proportion of decayed wood in the channel compared to a similar inventory on the Garcia River in Mendocino County, California. The small proportion of decayed pieces in the Pescadero-Butano water is indicative of instream wood removal. ESA et al. (2004) also noted that over half the conifer recruitment observed in their 23 sample reaches occurred in just two reaches located in Portola Redwoods State Park, suggesting the relatively mature forest stands in the park generate a high proportion of LWD recruited to the channels, and an inherently higher degree of protection of these attributes likely occurs due to government ownership. The paucity of LWD in areas outside the park likely is the major contributor to the lower shelter values estimated in the watershed (an average rating of 20 out of a possible total of shelter of 300). Action is considered In-Kind
PeC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	1	20	CalFire, IWRP, Mid Peninsula Open Space District, Private Landowners, Red Tree, San Mateo County, San Mateo RCD	99.50	99.50	99.50	99.50		398	Currently, the Pescadero watershed lacks a LWD inventory but available information indicates LWD is lacking. Assuming universal landowner approval and permission, the cost to install LWD in the 44.1 IP-km (27mi) = $397,446. Cost based on treating 13.5 miles (assume 1 project per mile in 50% High IP) at a rate of $29,440 We believe this cost would be significantly more in the Pescadero watershed due to concerns regarding LWD stability and flooding that would require more engineering. If ELJ used, cost would be $1,556,236. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Educate landowners, land managers, and County staff regarding the importance of Large Woody Material to steelhead survival and recovery, and watershed processes.	1	2	CalTrans, CDFW, FEMA, FishNet 4C, NMFS, San Mateo County, San Mateo RCD, State Parks						0	Program should initially be directed at landowners along important stream reaches where large wood removal has been identified as an ongoing concern by the resource agencies and the County of San Mateo. Cost estimate may expand if large wood removal continues to occur at current levels following completion of the program. The recommendation is based on ongoing efforts throughout the ten year period. Education effort would include workshops, mailings, fliers, signage, and focused presentations. Costs could be somewhat minimized through the use of existing materials already created nearby from the RCD of Santa Cruz County and County of Santa Cruz.
PeC-CCCS-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	1	20	CalFire, California Coastal Conservancy, CalTrans, CDFW, County of San Mateo, FEMA, FishNet 4C, NOAA RC, NRCS, Private Landowners, San Mateo RCD, USACE						0	This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. Action is considered In-Kind
PeC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	1	5	CalTrans, CDFW, IWRP, NMFS, Private Landowners, RWQCB, San Mateo RCD, State Parks, USACE	131.00					131	A comprehensive LWD inventory has not been conducted in Pescadero, however ESA (2004) did conduct reach level sampling in a discrete number of units and documented a paucity of LWD. A review of CDFW habitat typing information confirms the overall lack of wood formed structure. LWD installation should not wait until the completion of an inventory effort but should occur simultaneously. An appropriate approach would be beginning restoration actions in stream reaches with high IP values for both CCC coho and steelhead. Cost based on fish/habitat restoration at a rate of $130,753/project
PeC-CCCS-6.1.1.6	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	2	100	CalTrans, CDFW, FEMA, NMFS, Private Landowners, San Mateo County, San Mateo RCD, USACE						0	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Action is considered In-Kind
PeC-CCCS-6.1.1.7	Action Step	Habitat Complexity	Incorporate large woody debris (preferably large diameter redwood trees) into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CalTrans, CDFW, FEMA, NMFS, Private Landowners, San Mateo County, San Mateo RCD, USACE						0	Costs should be minimal because the bank protection action would likely occur anyway. This recommendation would be implemented only when an existing problem has been identified and is in needed of protection.
PeC-CCCS-6.1.1.8	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	Big Creek Lumber Co., CalFire, POST, Private Landowners, Red Tree, State Parks	134.00	134.00	134.00	134.00		536	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely or insignificant to downstream reaches. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost based on treating 4 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,675/acre.
PeC-CCCS-6.2	**Objective**	**Habitat Complexity**	**Address other natural or manmade factors affecting the species' continued existence**										
PeC-CCCS-6.2.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-6.2.1.1	Action Step	Habitat Complexity	Fund a watershed coordinator position.	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, California Geological Survey, CalTrans, CDFW, IWRP, Mid Peninsula Open Space District, NOAA RC, NRCS, Pescadero Municipal Advisory Council, POST, Private Landowners, RPFs, RWQCB, San Mateo County, San Mateo RCD, State Parks, SWRCB, USFWS	325.00	325.00				650	A watershed coordinator is necessary in Pescadero Creek watershed due to 1) the large number of small landowners adjacent to important watercourses and, 2) multiple governmental jurisdictions that often work in a limited and uncoordinated fashion in regard to restoration activities. A coordinator should be able to work with various stakeholders to facilitate rapid implementation of high priority restoration and habitat enhancement projects. A watershed coordinator should have a thorough understanding of social and environmental constraints and opportunities in the Pescadero Creek watershed. A qualified coordinator will be well versed in various State, County, and Federal permitting requirements and local issues and concerns with the various constituencies.
PeC-CCCS-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
PeC-CCCS-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalTrans, NRCS, RWQCB, San Mateo County, State Parks						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.
PeC-CCCS-8.1.1.2	Action Step	Sediment	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	CalFire, CalTrans, NRCS, Private Landowners, San Mateo County, San Mateo RCD, USACE						0	Cost are likely minimal if incorporated into general management plan for commercial and residential areas.
PeC-CCCS-8.1.1.3	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into Pescadero Creek.	3	100	CDFW, County of San Mateo, Mines and Geology, NRCS, RPFs, RWQCB, San Mateo RCD, State Parks, USACE						TBD	Extent of bank failures are unknown and costs were not estimated. Repairs should be completed using bioengineering techniques and material, where appropriate. Habitat enhancement should be incorporated into the engineering design, where appropriate. Areas with sandstone geology and areas with steep slopes and a mixed lithology should be considered the highest priority for this recommendation.
PeC-CCCS-8.1.1.4	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC steelhead recovery priorities.	3	10	CDFW, Farm Bureau, NMFS, NRCS, Private Landowners, San Mateo RCD						0	Action is considered In-Kind
PeC-CCCS-8.1.2	Recovery Action	Sediment	Improve gravel quantity and distribution for macro-invertebrate production (food)										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-8.1.2.1	Action Step	Sediment	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	100							0	Action is considered In-Kind
PeC-CCCS-8.1.2.2	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	2	100	CalFire, CalTrans, NRCS, POST, RWQCB, San Mateo County, State Parks						0	In a study on the San Lorenzo River in Santa Cruz County, Balance Hydrologics found stream reaches with a total of 1.5 to 2 bankfull widths (on both banks) of healthy native riparian vegetation offer the best instream habitat and have the most stable banks (Balance Hydrologics Inc 1998). These riparian width recommendations are also appropriate for Pescadero and would facilitate return of watershed processes to properly functioning conditions. Action is considered In-Kind
PeC-CCCS-8.1.2.3	Action Step	Sediment	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors.	3	20	CalTrans, Farm Bureau, Pescadero Municipal Advisory Council, Private Landowners, RWQCB, San Mateo County, San Mateo RCD						TBD	Re-vegetation would also facilitate amelioration of instream temperatures and would provide a source for future LWD recruitment. This recommendation will likely be received with some resistance by some landowners. Costs will vary depending on landowner participation and existing landuse.
PeC-CCCS-8.1.2.4	Action Step	Sediment	Encourage San Mateo County to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	3	100	Pescadero Municipal Advisory Council, Private Landowners, San Mateo County						TBD	High priority areas include locations adjacent to the Pescadero Marsh, areas within the historical tidal prism of the marsh that are candidates for restoration, and location in sandstone and/or steep mixed lithology geology. Other important areas include tributaries that maintain good quality or easily restored, and currently occupied habitats.
PeC-CCCS-8.2	**Objective**	**Sediment**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-8.2.1	Recovery Action	Sediment	Improve instream gravel quality										
PeC-CCCS-8.2.1.1	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	100	Farm Bureau, NRCS, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
PeC-CCCS-8.2.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, FEMA, NMFS, NRCS, RWQCB, San Mateo County, San Mateo RCD, USACE, USFWS						0	Inspections should be considered a standard business practice by all regulatory agencies and this action should not be considered as an additional cost.
PeC-CCCS-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-10.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
PeC-CCCS-10.1.1.1	Action Step	Water Quality	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	CalFire, CalTrans, Private Landowners, RWQCB, San Mateo County, USACE, USEPA						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-10.1.1.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10	CalFire, San Mateo County						0	Action is considered In-Kind
PeC-CCCS-10.1.1.3	Action Step	Water Quality	Encourage San Mateo County to establish wider riparian buffers in residential and urban areas.	2	10	CDFW, NMFS, Private Landowners, San Mateo County						0	This will likely be a sensitive issue for many landowners with property located next to riparian areas. This recommendation should be applied to all new development projects. Action is considered In-Kind
PeC-CCCS-10.1.1.4	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100	Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD						0	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort. Action is considered In-Kind
PeC-CCCS-10.1.2	Recovery Action	Water Quality	Improve stream temperature conditions										
PeC-CCCS-10.1.2.1	Action Step	Water Quality	Implement actions to maintain and restore water temperatures to meet habitat requirements for salmonids in specific stream reaches.	2	25							0	Cost accoundted for in implementation of other action steps.
PeC-CCCS-10.1.2.2	Action Step	Water Quality	Plant native vegetation to promote streamside shade, where water temperatures exceed maximum tolerance levels for steelhead.	3	30	CalFire, California Coastal Conservancy, CDFW, County of San Mateo, Farm Bureau, NMFS, NRCS, San Mateo RCD, USACE, USFWS	315.00	315.00	315.00	315.00	315.00	1,890	The fiscal costs of riparian revegetation or planting depend on the complexity of the project undertaken, the remoteness of the parcel of land to be treated, and the degree of site preparation needed. According to CDFG 2004, Evergreen Funding Consultants suggest a budget of between 5,000 dollars and 135,000 dollars per acre. Areas where this practice should be targeted would include lower mainstem reaches (on Butano and Pescadero below Loma Mar) where the canopy is most impaired from historical conditions. Cost based on treating 1 mile (assume 5% of high IP with 80 acres/mile)) at a rate of $23,619/acre.
PeC-CCCS-10.1.3	Recovery Action	Water Quality	Improve stream water quality conditions										
PeC-CCCS-10.1.3.1	Action Step	Water Quality	Evaluate point and non-point sources contributing to poor water quality, including sources contributing debris, pesticides, and sediment (turbidity); develop and implement a plan to address these sources.	2	100	CDFW, County of San Mateo, RWQCB						0	Cost associated with CCRWQCB objectives.
PeC-CCCS-10.1.3.2	Action Step	Water Quality	Evaluate water quality below likely sources of contamination.	2	10	County of San Mateo, Pescadero Municipal Advisory Council, RWQCB, USEPA	11.50	11.50				23	Any waste water should meet the highest water quality standards if the water is likely to enter the estuary or the waters of Butano of Pescadero Creeks. Cost based on water quality monitoring at a rate of $763/site with a minimum of 3.
PeC-CCCS-10.1.3.3	Action Step	Water Quality	Waste water from future and current waste water treatment facilities should not impair water quality conditions.	2	100	County of San Mateo, RWQCB, USEPA						0	Any waste water should meet the highest water quality standards if the water is likely to enter the estuary or the waters of Butano of Pescadero Creeks. Action is considered In-Kind
PeC-CCCS-10.1.3.4	Action Step	Water Quality	Address water quality issues that result in fish kills in Pescadero estuary.	1	5	CDFW, NMFS, NOAA RC, RWQCB, San Mateo County, State Parks, USEPA						0	Action is considered In-Kind
PeC-CCCS-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-11.1.1.1	Action Step	Viability	Measure or estimate response of key habitat attributes to recovery efforts across the watershed.	2	12		109.17	109.17	43.67			262	Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum and therefore, Pescadero ranks lower in overall priority in the immediate future. However, it will ultimately be important to begin assessing the overall run size in Pescadero. Redd monitoring may be less expensive than establishing a site to count migrating adults and smolts. Cost based on fish/habitat restoration monitoring at a rate of $130,941/project
PeC-CCCS-11.1.1.2	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.	2	10	CalFire, CDFW, NMFS, RWQCB, USFWS						TBD	Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum and therefore, Pescadero ranks lower in overall priority in the immediate future. However, it will ultimately be important to begin assessing the overall adult run size in Pescadero due to its designation as an Independent watershed for both coho and steelhead. Redd monitoring using (GTRS sampling design) may be less expensive than establishing life cycle station to count migrating adults and smolts. All assessments should use standardized methods. Methods should be consistent across the ESU or at a minimum the Santa Cruz Mtns Diversity Stratum. Results from past assessments can be used in some circumstances to jump start restoration actions and need not necessarily wait upon completion of a standardized assessment protocol.
PeC-CCCS-11.1.1.3	Action Step	Viability	Monitor population status for response to recovery actions.	3	25	CDFW, NOAA SWFSC, Private Landowners, State Parks						0	Cost for populations status and trends monitoriing are accounted for in the Monitoring Chapter.
PeC-CCCS-11.1.1.4	Action Step	Viability	Establish a life cycle station in Pescadero Creek or utilize assessment methods that comport to those of Gallagher and Gallagher (2005) or the Coastwide Monitoring Plan.	3	12	CDFW, NOAA SWFSC, Private Landowners, State Parks						0	Cost for populations status and trends monitoriing are accounted for in the Monitoring Chapter.
PeC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PeC-CCCS-12.1.1.1	Action Step	Agriculture	Reduce discharge of chemical effluent and sediment related to agricultural practices.	3	20	County of San Mateo, Farm Bureau, NRCS, RWQCB, San Mateo RCD						TBD	TBD, based on the number of farmed acres that need improvements to sediment and chemical effluent discharges from agriculture.
PeC-CCCS-12.1.1.2	Action Step	Agriculture	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	100	County of San Mateo, Farm Bureau, NRCS, RWQCB, San Mateo RCD	2.50	2.50	2.50	2.50	2.50	50	This is a focused strategy to control sediment. Additional sediment control recommendations are presented under the Sediment section. Cost estimate would only apply to outreach efforts to the agricultural community.
PeC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance										
PeC-CCCS-12.1.2.1	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	County of San Mateo, Farm Bureau, Private Landowners, San Mateo RCD	50.00	50.00				100	Cost is a rough estimate and could be significantly reduced if Sotoyome recommendations are directly adopted with minimal site specific adaptations. More site specific issues will likely increase costs. A large portion of the estimated cost would likely be incurred from outreach activities. These cost estimates do not include matching funding or land owner expenses. Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort.
PeC-CCCS-12.1.3	Recovery Action	Agriculture	Prevent or minimize adverse alterations to riparian species composition and structure										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-12.1.3.1	Action Step	Agriculture	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors.	3	10	CalTrans, County of San Mateo, Farm Bureau, Pescadero Municipal Advisory Council, Private Landowners, RWQCB, San Mateo RCD	24.00	24.00				48	Re-vegetation would also facilitate amelioration of instream temperatures and would provide a source for future LWD recruitment. This recommendation will likely be received with some resistance by some landowners. Cost based on treating 1 mile (assume 5% of high IP) at a rate of $23,619/acre. Costs may vary depending on landowner participation and existing landuse.
PeC-CCCS-12.1.3.2	Action Step	Agriculture	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	60	CDFW, County of San Mateo, Farm Bureau, Pescadero Municipal Advisory Council, Private Landowners, RWQCB, San Mateo RCD						0	Action is considered In-Kind
PeC-CCCS-12.1.3.3	Action Step	Agriculture	Purchase conservation easements or develop conservation banks with landowners that currently have ongoing grazing or agricultural operations adjacent to the Pescadero estuary.	3	100	CDFW, County of San Mateo, Farm Bureau, Private Landowners, San Mateo RCD, State Parks						TBD	Costs will vary depending on the amount of willing landowners participating in the program, market value, and rate of availability. Land owners willing to develop easements that could ultimately be used for estuary restoration should be given the highest priority. Conservation easements are a cost effective strategy.
PeC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology										
PeC-CCCS-13.1.1.1	Action Step	Channel Modification	Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.	2	50	CDFW, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, State Parks						TBD	TBD, cost will vary depending upon the amount and extent of obsolete bank structures. Assume approximately $10,258/acre to reconnect floodplain. Additional cost incurred for habitat features such as riparian planting, LWD placement, and non-native species control.
PeC-CCCS-13.1.1.2	Action Step	Channel Modification	Remove some or all of the levees in the Pescadero Marsh.	3	5	CDFW, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, State Parks	37.00					37	NMFS (2008) estimated floodplain and tributary reconnection could range in cost from $8,721 to $81,395 per acre. Costs in Pescadero Marsh would likely be at the higher edge of that estimate range. If side channel restoration is proposed NMFS (2008) estimated cost could range between $34,884 and $290,698 per acre. Diking, channelization, reclamation, and excessive sedimentation have dramatically altered the size and character of Pescadero Marsh over the past 150 years. Between 1900 and 1960 the size of the delta/open water area of the marsh decreased by over 50%, primarily due to reclamation of marshland for agriculture. CEMAR (2010) discussed a number of potential restoration actions that could include (1) lowering the right bank levee of Pescadero Creek at the upper end of the Marsh, (2) Raising or repairing the low levee along the channel adjacent to North Marsh that leads to North Pond, and (3) Remove some or all of the remaining levees between Butano Creek and Butano Marsh. Cost based on treating 1 mile (assume1% of high IP) at a rate of $37,200/mile for floodplain connectivity.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-13.1.1.3	Action Step	Channel Modification	Remove obsolete structures in mainstem and tributary reaches.	2	20	CalTrans, CDFW, Farm Bureau, NMFS, RWQCB, San Mateo RCD, State Parks, USACE, USFWS						TBD	TBD, costs cannot be determined at this time. An evaluation of the number of structures is needed and costs will vary depending on site specific conditions.
PeC-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	10	CalTrans, CDFW, County of San Mateo, FEMA, NRCS, RWQCB, San Mateo RCD, USACE	94.00	94.00				188	Cost based on erosion assessment assuming 25% of total watershed acres at a rate of $14.39/acre.
PeC-CCCS-13.1.1.5	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	3	100	CalTrans, CDFW, County of San Mateo, FEMA, NRCS, RWQCB, San Mateo RCD, USACE						0	This should be considered a standard business practice for all practitioners of instream bank stabilization.
PeC-CCCS-13.1.1.6	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	3	100	CalFire, CDFW, County of San Mateo, FEMA, POST, Private Landowners, RWQCB, San Mateo RCD, USACE						0	This should be adopted as standard practice.
PeC-CCCS-13.1.1.7	Action Step	Channel Modification	Develop a mitigation policy that requires In-Kind replacement of removed and functioning instream large woody debris.	2	5	CDFW, NMFS, San Mateo County	40.00					40	Policy could be applied to all targeted San Mateo County streams. Estimated cost of developing a new policy and staff time. Mitigation could include replacing removed wood with instream habitat features in other critical stream reaches deficient in habitat complexity.
PeC-CCCS-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity										
PeC-CCCS-14.1.1.1	Action Step	Disease/ Predation/ Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.	3	20	Private Landowners, San Mateo RCD	1,553	1,553	1,553	1,553		6,210	Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of $38,813/acre.
PeC-CCCS-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
PeC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire						0	This recommendation should be considered a standard practice.
PeC-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, San Mateo County, San Mateo RCD						0	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, San Mateo County, San Mateo RCD						0	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Some areas in the Pescadero watershed have high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, higher stream temperatures, which are already above optimal condition along the mainstem, would likely result. Action is considered In-Kind
PeC-CCCS-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						0	Standard practice.
PeC-CCCS-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide a fire contingency to all non-County fire fighters when providing firefighting assistance in the Pescadero Creek watershed (and all other watersheds in the County).	2	100	CalFire, San Mateo County, San Mateo RCD						0	Action is considered In-Kind
PeC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
PeC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	2	10	CalFire, San Mateo County, San Mateo RCD						0	Action is considered In-Kind
PeC-CCCS-15.1.2.2	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, San Mateo County, San Mateo RCD						0	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations (e.g., drafting water from areas other than Pescadero lagoon). Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire. Action is considered In-Kind
PeC-CCCS-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PeC-CCCS-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire							Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
PeC-CCCS-15.1.4	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
PeC-CCCS-15.1.4.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC steelhead.	2	100	CalFire						0	This recommendation should be adopted in areas where human life and infrastructure and not endangered by fire. Action is considered In-Kind
PeC-CCCS-15.1.4.2	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	3	30	CalFire						0	Action is considered In-Kind
PeC-CCCS-15.1.4.3	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	100	CalFire, CDFW, NMFS, USFWS						0	Action is considered In-Kind
PeC-CCCS-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate recommendations from NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	2	CalFire						0	Action is considered In-Kind
PeC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	2	100	CalFire, CDFW, NMFS						0	Guidance could include informing CalFire of sensitive biological resources in the watershed as well as recommendations regarding sensitive watersource location (e.g., Pescadero estuary). Action is considered In-Kind
PeC-CCCS-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
PeC-CCCS-15.2.2.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, San Mateo RCD, and regulatory agencies with expertise in fisheries issues.	2	3	CalFire, County of San Mateo, NMFS, San Mateo RCD, USFWS	100.00					100	Cost may be significantly reduced if existing plans and protocols are adopted (e.g. USFS protocols). Costs may be higher if site specific constraints and agency and community reluctance to adopt existing NMFS and USFWS approved protocols exists.
PeC-CCCS-15.2.2.2	Action Step	Fire/Fuel Management	Disseminate plan to all local fire fighting agencies.	2	50							0	Action is considered In-Kind
PeC-CCCS-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity										
PeC-CCCS-16.1.1.1	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFW, NMFS						0	Action is considered In-Kind
PeC-CCCS-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CalTrans, CDFW, Public, State Parks						0	If river mouth has been artificially breeched without appropriate authorization, prohibitions on offshore should continue until appropriate flows occur. Action is considered In-Kind
PeC-CCCS-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFW to modify the low flow minimum flow closure in Title 14, Section 8.00(b)(1) of the California Code of Regulations to include Pescadero Creek.	2	3	CDFW, NMFS						0	Low flow closures are needed for the Pescadero Creek based on flow conditions from a nearby watershed in the Santa Cruz Mountains. Consideration should be given to pushing the entire fishing season back so that the total number of angling days is not reduced significantly. Action is considered In-Kind
PeC-CCCS-16.1.1.4	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along Pescadero Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	1	10	CDFW, Pescadero Municipal Advisory Council, Private Landowners, San Mateo County, San Mateo RCD	7.50	7.50				15	Cost for signs varies widely depending on materials and content of signs. Cost based on $500/sign. Assume a minimum of 30.
PeC-CCCS-16.1.1.5	Action Step	Fishing/Collecting	Increase oversight on anglers fishing in Pescadero to evaluate compliance with fishing regulations.	2	10	CDFW, CDFW Law Enforcement, NMFS OLE						0	Action is considered In-Kind
PeC-CCCS-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
PeC-CCCS-18.1.1.1	Action Step	Livestock	Reduce the adverse effects of grazing and ranching to water quality in the Bradley Creek subwatershed.	3	30	Farm Bureau, Private Landowners, San Mateo RCD						TBD	Cost cannot be determined due to variability of landowner participation and extent of impacts.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-18.1.1.2	Action Step	Livestock	Establish and implement a conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.	3	15	CDFW, NRCS, Private Landowners						0	This recommendation should be considered standard practice.
PeC-CCCS-18.1.1.3	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on the steeper slopes in this area.	3	100	Farm Bureau, NRCS, Private Landowners, RWQCB, San Mateo RCD						0	The lower Pescadero is vulnerable to gully initiation. Establishing conservative targets would reduce the total number of AUM but would also reduce restoration costs to address gullies. Action is considered In-Kind
PeC-CCCS-18.1.2	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										
PeC-CCCS-18.1.2.1	Action Step	Livestock	Locate water sources away from riparian areas.	3	100	Farm Bureau, NRCS, Private Landowners, San Mateo RCD						TBD	CDFW estimated water control structures at $15,000 each. The cost of moving a water source for grazing cattle is likely much lower. However, costs cannot be estimated because landowner participation is unknown and site specific conditions are currently unknown.
PeC-CCCS-18.1.2.2	Action Step	Livestock	Aid landowners willing to fence off riparian areas in choosing alternatives water source sites (preferably ones that are hydrologically disconnected from stream flows).	2	100	Farm Bureau, Private Landowners, San Mateo RCD						TBD	CDFG 2004 estimates fencing costs in 2002 dollars at $4 per LF. Costs may be higher in the Pescadero watershed. Total costs are unknown and may vary depending on landowner participation and total amount of habitat fenced.
PeC-CCCS-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCCS-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, CDFW, Private Landowners, San Mateo County						0	This recommendation should be considered standard practice.
PeC-CCCS-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PeC-CCCS-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, CDFW, Private Landowners, San Mateo County						TBD	Cost for this recommendation will be determined by feasibility of road surface treatment and extent of miles of road to be treated.
PeC-CCCS-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
PeC-CCCS-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, CDFW, Private Landowners, San Mateo County						0	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered. Action is considered In-Kind
PeC-CCCS-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CalFire, Private Landowners						0	Cost accounted for in other recovery actions. See Habitat Complexity.
PeC-CCCS-19.1.4	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
PeC-CCCS-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFW, Private Landowners, San Mateo County						0	This recommendation should be considered standard practice.
PeC-CCCS-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, CDFW, Private Landowners, San Mateo County						0	Action is considered In-Kind

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PeC-CCCS-19.1.4.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFW, Private Landowners, San Mateo County						0	This action should be considered a high priority within the Butano watershed. This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes). Action is considered In-Kind
PeC-CCCS-19.1.5	Recovery Action	Logging	Prevent or minimize impairment to water quality (impaired stream temperature)										
PeC-CCCS-19.1.5.1	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, CDFW, Private Landowners, San Mateo County						0	Action is considered In-Kind
PeC-CCCS-19.1.6	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
PeC-CCCS-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, CDFW, Private Landowners, San Mateo County						0	Action is considered In-Kind
PeC-CCCS-19.1.7	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
PeC-CCCS-19.1.7.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, CDFW, Private Landowners, San Mateo County						0	Action is considered In-Kind
PeC-CCCS-19.1.7.2	Action Step	Logging	Avoid road construction in riparian zones	2								0	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction within the Butano watershed. Action is considered In-Kind
PeC-CCCS-19.1.7.3	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	3	100	CalFire, CDFW, Private Landowners, San Mateo County						TBD	Cost for this recommendation depend on extent and feasibility of decommissioning legacy roads and landings.
PeC-CCCS-19.1.7.4	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest for roads located in areas prone to erosion and high rates of sediment delivery.	2	100	Board of Forestry, CalFire, CDFW, County of San Mateo, Private Landowners						TBD	Cost is contingent on future rate of harvest and extent and existing conditions of road network. This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
PeC-CCCS-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
PeC-CCCS-19.2.1.1	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of steelhead	3	20	Big Creek Lumber Co., Private Landowners, Red Tree						0	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Other considerations could potentially cover timber harvest activities for multiple watersheds within San Mateo County. Action is considered In-Kind
PeC-CCCS-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	Big Creek Lumber Co., CalFire, CDFW, Private Landowners, Red Tree, Redwood Empire						0	Installing large woody material into stream deficient in large wood should be considered a top restoration priority, particularly high priority subwatersheds. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint. Action is considered In-Kind

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PeC-CCCS-19.2.1.3	Action Step	Logging	Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.	3	100							0	Action is considered In-Kind
PeC-CCCS-19.2.1.4	Action Step	Logging	Discourage San Mateo County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CDFW, NMFS, San Mateo County						0	Maintaining forestlands as functional forests is a key strategy for returning the watershed to properly functioning conditions. Action is considered In-Kind
PeC-CCCS-19.2.1.5	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CDFW, NMFS, San Mateo County						0	Action is considered In-Kind
PeC-CCCS-19.2.2	Recovery Action	Logging	Prevent or minimize impairment to water quality (impaired stream temperature)										
PeC-CCCS-19.2.2.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, Private Landowners, RPFs, RWQCB							Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC DPS) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for steelhead rearing.
PeC-CCCS-22.1	**Objective**	**Residential/ Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
PeC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004). Removal should only occur after careful review and consideration.	2	100							0	Action is considered In-Kind
PeC-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.	1	10	CDFW, County of San Mateo, NMFS, Pescadero Municipal Advisory Council, San Mateo RCD, USACE						0	This is an obligation of the resource agencies. Action is considered In-Kind
PeC-CCCS-22.1.1.3	Action Step	Residential/ Commercial Development	Remove logs and debris from streams only as a "last resort" (i.e., failure to remove them will certainly cause the loss of an essential facility) after consultation with a hydrologist and/or qualified fisheries biologist.	1	100	CalTrans, CDFW, County of San Mateo, FEMA, NMFS, Private Landowners, USACE						TBD	Cost will depend on the frequency of problematic areas and the material to be removed. Additionally, costs may be highly variable depending on water year and flooding. Costs of hiring a qualified consulting fisheries biologist and/or a qualified hydrologist may range from $50 to >$200 per hour.
PeC-CCCS-22.1.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
PeC-CCCS-22.1.2.1	Action Step	Residential/ Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	CalFire, CalTrans, County of San Mateo, RWQCB, USACE						0	Action is considered In-Kind
PeC-CCCS-22.1.2.2	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.	3	100	County of San Mateo, FishNet 4C, RWQCB						0	Action is considered In-Kind
PeC-CCCS-22.2	**Objective**	**Residential/ Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Minimize future urban development in floodplains or off-channel habitats	2	10	County of San Mateo						0	See recommended strategies for Floodplains and Riparian areas. Action is considered In-Kind

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-22.2.1.2	Action Step	Residential/ Commercial Development	Encourage San Mateo to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	2	100	County of San Mateo, Pescadero Municipal Advisory Council, Private Landowners, USFWS						0	High priority areas include locations adjacent to the Pescadero Marsh, areas within the historical tidal prism of the marsh that are candidates for restoration, and location in sandstone and/or steep mixed lithology geology. Other important areas include tributaries that maintain good quality or easily restored, and currently occupied habitats. Action is considered In-Kind
PeC-CCCS-22.2.1.3	Action Step	Residential/ Commercial Development	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalTrans, County of San Mateo, Mines and Geology, Private Landowners, RWQCB, USACE						0	Costs should be minimal if this concept is adopted early in the planning process for all new development. Development in Pescadero Marsh should occur outside of the historical tidal prism and areas of high value IP habitat.
PeC-CCCS-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PeC-CCCS-22.2.2.1	Action Step	Residential/ Commercial Development	Support the development and implementation of regulations for activities that intercept groundwater recharge (e.g., use of subsurface tiles in vineyards, impervious surfaces, etc.).	2	5	CDFW, County of San Mateo, Public, SWRCB						0	Costs of changing existing regulations should be minimal. Many existing templates for this type of action already exist and could be incorporated into new regulations.
PeC-CCCS-22.2.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PeC-CCCS-22.2.3.1	Action Step	Residential/ Commercial Development	Avoid, or at a minimum minimize, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	2	20	USEPA						0	Action is considered In-Kind
PeC-CCCS-22.2.3.2	Action Step	Residential/ Commercial Development	Work with jurisdictional agencies to prohibit and or restrict transport of highly toxic chemicals on the Pescadero road corridor through the Pescadero Creek watershed.	3	10	CalTrans, CDFW, County of San Mateo, NMFS, USEPA	15.00	15.00				30	Cost would include rerouting traffic. Chemical spills are an infrequent occurrence but the consequences can be devastating if such an event were to happen.
PeC-CCCS-22.2.3.3	Action Step	Residential/ Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	3	100	CalTrans, CDFW, County of San Mateo, RWQCB, USEPA						0	Particular attention should be directed at actions adjacent of high risk areas such as the Pescadero Marsh. Action is considered In-Kind
PeC-CCCS-22.2.3.4	Action Step	Residential/ Commercial Development	Minimize sediment input from existing and future commercial development.	3	25	County of San Mateo, RWQCB						0	Action is considered In-Kind
PeC-CCCS-22.2.3.5	Action Step	Residential/ Commercial Development	New development in all historical CCC steelhead watersheds should minimize storm-water runoff, changes in duration, or magnitude of peak flow.	3	100	CalTrans, County of San Mateo, RWQCB, State Parks, USACE							These costs are likely minimal because of the relatively low rate of development in the watershed likely precludes the necessity of significant flood detention basins, etc.
PeC-CCCS-22.2.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance										
PeC-CCCS-22.2.4.1	Action Step	Residential/ Commercial Development	Design new developments to minimize impacts from unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC steelhead watercourse.	2	100	CalTrans, CDFW, County of San Mateo, FEMA, Private Landowners, RWQCB, State Parks, USACE						0	Stringent review by permitting agencies is expected to reduce ancillary costs associated with poorly planned and poorly located developments. Priority areas that should be avoided include the estuary and geologies with steep mixed lithology and the sandstone geologies in the watershed. Action is considered In-Kind
PeC-CCCS-22.2.4.2	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	CalFire, CalTrans, County of San Mateo, Private Landowners, RWQCB, USACE, USEPA						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Cost can likely be incorporated into ongoing road public works upgrades.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-22.2.4.3	Action Step	Residential/ Commercial Development	Avoid or minimize the effects from flood control projects on salmonid habitat.	1	100	CalTrans, County of San Mateo, FEMA, NRCS, RWQCB, State Parks, USACE						0	Cost of minimizing the effects of development within the floodplain should result in a long term cost savings. The Pescadero Marsh or its historical tidal prism are of particular importance to ensure the avoidance of future flood control projects. Action is considered In-Kind
PeC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										
PeC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	48.75	48.75	48.75	48.75		195	This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides. Cost based on road inventory assessment at a rate of $1,215/mile for 160 miles (assume 75% of road network)..
PeC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, CalTrans, Private Landowners, San Mateo County	131.25	131.25	131.25	131.25	131.25	2,625	Replacement of culverts/bridges and upgrading to NMFS standards will result in increased cost for materials and construction but will likely result in structures that can withstand large storm events better than many existing structures. This recommendation should be considered standard practice. Cost based on upgrading 10 road crossing (assume minor 2 lane road and 25% of total crossings upgraded) at a rate of $262,462/unit.
PeC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	2	10	CalFire, CalTrans, Private Landowners, San Mateo County						TBD	Many road associations are inadequately funded. A road improvement fund for the Pescadero could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity. This action encourages implementation of many existing policies. Cost accounted in part in other recovery actions. Setting up database is likely minimal cost once road inventory is completed.
PeC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	17.75	17.75	17.75	17.75		71	Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards. Targeted areas should include sub watersheds with high erosion potential (e.g., lower portion of the Pescadero watershed). Roads that receive frequent use by the public will be very difficult to decommission; roads in more remote areas, particularly those historically used for timber harvest or in public ownership will likely be much easier to target for decommissioning. Roads located in steep sandstone geology or nearstream sandstone geology should receive the highest priority for decommissioning. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 5 miles of road network at a rate of $14,131/mile.
PeC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County						0	ESA et al. (2004) noted that while construction and maintenance practices are steadily improving, there are many miles of unused and/or abandoned secondary roads on both public and private lands that have not been properly upgraded or decommissioned commensurate with the decrease in management intensity in the basin. Many of these roads may be poorly designed with regard to drainage (ESA et al. 2004). Even though chronic fine sediment production decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to many forms of erosion, including culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (ESA et al. 2004). On many forest and ranch roads located on both public and private lands, periodic maintenance occurs in the absence of an attempt to address chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossing can continue sediment delivery. Action is considered In-Kind
PeC-CCCS-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County	94.50	94.50				189	Some road assessment have already been conducted in the watershed. Initial assessment efforts should target high [priority subwatersheds. Existing assessments should be used when possible. Cost for road inventory accounted for in above action steps. Cost for erosion assessment estimated at $14.49/acre (assume 25% of total watershed acres).
PeC-CCCS-23.1.2.3	Action Step	Roads/Railroads	Reduce erosion from mainline timber harvest roads.	2	20	CalFire, CDFW, RWQCB, San Mateo County						0	Road densities are high throughout the watershed, estimated at 2.7 miles of road per square mile of watershed area, and at 3.2 miles per square mile of riparian area. Many of these roads are poorly situated and constructed, and improperly maintained. Roads were ranked as accounting for the largest percentage of total sediment delivery in the watershed from 1983-2002 by ESA et al. (2004). The total road-related sediment delivery rate during this time period was estimated at 50,379 yards^3 per year, which is more than twice the combined sediment delivery of all other land use in the watershed. Cost accounted for in other recovery actions and will incorporate measures to reduce road densities. Action is considered In-Kind
PeC-CCCS-23.1.2.4	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	20	CalFire, CalTrans, NRCS, Private Landowners, San Mateo County						TBD	Partial barriers are present in the Pescadero watersehd. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz County have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. If bridges are not feasible, replacement culverts on fish bearing streams must have a natural bottom. Cost accounted for road inventory assessment.
PeC-CCCS-23.1.2.5	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from steelhead streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	5	CalFire, CalTrans, RWQCB, San Mateo County, State Parks						TBD	Inadequate storage of sediment has been an ongoing issue in Pescadero watershed. The paucity of locations for temporary storage of landslide material is a significant constraint. Sites should be identified within the duration specified and this action should be continued in perpetuity. Future efforts may require incentives to increase landowner participation. Cost estimates cannot be determine until the feasibility and quantity of adequate spoils storage site is completed.
PeC-CCCS-23.1.2.6	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County						TBD	Roadside berms can result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails).

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-23.1.2.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County, State Parks						TBD	Cost for type and quantity of energy dissipaters will be determined from road inventory assessment. However, this should be considered a standard business practice and minimal costs are anticipated.
PeC-CCCS-23.1.2.8	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, IWRP, NRCS, Private Landowners, State Parks						0	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Action is considered In-Kind
PeC-CCCS-23.1.2.9	Action Step	Roads/Railroads	Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	100	Caltrans, County, NMFS						0	Action is considered In-Kind
PeC-CCCS-23.1.2.10	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	20	CalTrans, CDFW, County of San Mateo, FishNet 4C, San Mateo RCD, Santa Cruz County, Santa Cruz RCD, State Parks						TBD	Similar existing programs could be modified and implemented at minimal cost.
PeC-CCCS-23.1.2.11	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. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalTrans, FEMA, San Mateo County, State Parks						TBD	Costs are difficult to accurately determine but it may result in a long term cost savings. San Mateo County should seek amendments to FEMA policies to facilitate improvements that prevent erosion and failure, particularly for watersheds targeted in this and the CCC coho salmon recovery plan.
PeC-CCCS-23.1.2.12	Action Step	Roads/Railroads	Encourage County to continue to implement the San Mateo County Road Maintenance Manual	2	100	San Mateo County						0	Action is considered In-Kind
PeC-CCCS-23.1.2.13	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, CalTrans, County of San Mateo, Farm Bureau						TBD	Estimates of cost will require estimates on long term maintenance commitments. Maintenance costs may be highly variable depending on location and rainfall year. Years of high rainfall will require more frequent maintenance.
PeC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
PeC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	20	CalTrans, IWRP, Private Landowners, San Mateo County, San Mateo RCD	905	905	905	905		3,620	Few partial barriers are present in the Pescadero Watershed. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz Mountains Diversity Stratum have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. Cost based on treating 7 impassable barriers at a rate of $517,078/barrier.
PeC-CCCS-23.1.3.2	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.	3	100	CalFire, CalTrans, CDFW, County of San Mateo, FEMA, NOAA RC, NRCS, Private Landowners, RPFs, RWQCB, State Parks, USACE						TBD	Replacement of culverts/bridges and upgrading to NMFS standards will result in increased cost for materials and construction but will likely result in structures that can withstand large storm events better than many existing structures. This recommendation applies to all stream crossings, including those on Class 2-3 streams.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-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	CalFire, CalTrans, County of San Mateo, FEMA, NRCS, State Parks, USACE						TBD	Cost may vary significantly, but should be considered standard practice. These criteria should apply to all new bridge projects. Bridges should be sized to accommodate flows and associated debris.
PeC-CCCS-23.1.3.4	Action Step	Roads/Railroads	Replace problematic culverts and low flow crossings streams with bridges or appropriate cost effective designs.	3	50	CalFire, CalTrans, CDFW, County of San Mateo, FEMA, NOAA RC, NRCS, RWQCB, State Parks, USACE						TBD	Partial barriers are present in the Pescadero watersehd. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz County have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. If bridges are not feasible, replacement culverts on fish bearing streams must have a natural bottom. TBD costs are based on the number of crossings needing to be replaced and the alternative selected.
PeC-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure										
PeC-CCCS-23.1.4.1	Action Step	Roads/Railroads	Encourage adoption and implementation of a plan similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation 2008) regarding roadside maintenance activities. This plan was developed to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalFire, CalTrans, FEMA, IWRP, NRCS, San Mateo County, San Mateo RCD, USACE						0	Action is considered In-Kind
PeC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
PeC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Encourage San Mateo County to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	San Mateo County						0	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within Pescadero Creek and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degrade streambed conditions in the watershed. Action is considered In-Kind
PeC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CDFW, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, San Mateo County, USACE, USFWS						0	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions. Action is considered In-Kind

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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PeC-CCCS-23.2.2.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	5	CalFire, CalTrans, Mid Peninsula Open Space District, POST, San Mateo County, State Parks						0	A well designed road management plan should result in overall cost savings due to lower maintenance costs. Particular emphasis should be directed at avoiding new road construction within the historical tidal prism of the Pescadero Marsh in order to avoid precluding future restoration actions and areas of high IP value. Action is considered In-Kind
PeC-CCCS-23.2.2.3	Action Step	Roads/Railroads	Work with the county and Caltrans to develop road management plans.	2	30	CalFire, CalTrans, County of San Mateo, San Mateo RCD, State Parks						0	Action is considered In-Kind
PeC-CCCS-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
PeC-CCCS-23.2.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, CalTrans, CDFW, Mid Peninsula Open Space District, NMFS, NRCS, POST, Private Landowners, RPFs, RWQCB, San Mateo County, USACE						0	Standard practice; however, implementation may be difficult in the watershed due to the large number of small landowners and varying degree of financial resources. County of San Mateo evaluated roads and trails and likely have a good idea of priority locations that should be addressed on an annual basis. Rural roads should receive the majority of the attention vs. mainline roads in the watershed.
PeC-CCCS-23.2.3.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	CalFire, RPFs, RWQCB, San Mateo County, USACE						0	This should be considered the minimum standard for dirt roads in the watershed. Action is considered In-Kind
PeC-CCCS-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	CalFire, NRCS, Public, RPFs, San Mateo County, USACE						0	Cost should be considered part of land owner road management plans.
PeC-CCCS-23.2.3.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, RWQCB						0	Action is considered In-Kind
PeC-CCCS-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**										
PeC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										
PeC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	FEMA, State Parks, USACE						0	Cost accounted for in ESTUARY.
PeC-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	FEMA, State Parks, USACE						0	Cost accounted for in ESTUARY.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, State Parks, USACE						0	Cost accounted for in ESUARY.
PeC-CCCS-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PeC-CCCS-24.1.2.1	Action Step	Severe Weather Patterns	Identify and eliminate depletion of base flows from unauthorized water uses.	2	10	S	34.00	34.00				68	Cost based on stream flow/precipitation gauging for water balance model at a rate of $67,036/project.
PeC-CCCS-24.1.2.2	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies.	1	5	Private Landowners, SWRCB						0	The SWRCB should conduct periodic sweeps of diversions in Pescadero Creek to ensure they are in compliance with annual reporting requirements and that annual water usage is accurately reported. Action is considered In-Kind
PeC-CCCS-24.1.2.3	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	1	5	CDFW, County of San Mateo, NMFS, SWRCB						0	Cost will likely be staff time expense. Efforts should initially be directed at minimizing impacts of diversions during drought years. Action is considered In-Kind
PeC-CCCS-24.1.2.4	Action Step	Severe Weather Patterns	Flows values during droughts should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	1	5	CDFW, NMFS, SWRCB						TBD	This cost may be significant and will require development of a water budget (possibly an IFIM) for Pescadero Creek. Costs are based on stream flow/precipitation monitoring accounted for above. Costs for improving or preserving bypass flows will be determined once those values are assessed.
PeC-CCCS-24.1.2.5	Action Step	Severe Weather Patterns	Work with water diverters 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, County of San Mateo, NMFS, SWRCB						0	Action is considered In-Kind
PeC-CCCS-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (impaired stream temperature)										
PeC-CCCS-24.1.3.1	Action Step	Severe Weather Patterns	Work with Private Landowners and RWQCB to ensure tolerable water temperatures are maintained during drought periods.	2	5	Private Landowners, RWQCB, SWRCB	5.00					5	Water temperatures during drought will be directly affected by ongoing surface water diversions in Pescadero Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost based on stream temperature monitoring (assume minimum of 10 sites) at a cost of $500/unit. Cost estimate does not account for maintenance or data management.
PeC-CCCS-24.1.3.2	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	Private Landowners, RWQCB, SWRCB						0	This recommendation should be considered standard practice.
PeC-CCCS-24.1.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration										
PeC-CCCS-24.1.4.1	Action Step	Severe Weather Patterns	Work with CDFW, County of San Mateo, and knowledgeable biologists to develop emergency rules that consider the lifehistory requirements of salmonids and adopt implementation agreements regarding contingency efforts during drought conditions.	3	10	CDFW, NMFS, Private Landowners, SWRCB						0	Action is considered In-Kind
PeC-CCCS-24.1.4.2	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	3	2	CDFW Law Enforcement, NMFS OLE						0	Costs are anticipated to be absorbed into ongoing activities.

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-24.1.4.3	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CalFire, CalTrans, CDFW, NMFS, RWQCB, SWRCB						0	Action is considered In-Kind
PeC-CCCS-24.1.4.4	Action Step	Severe Weather Patterns	Evaluate performance of all existing fish ladders to pass migrating fish during drought conditions.	2	5	CalTrans, CDFW, NOAA RC, San Mateo County	42.00					42	Evaluation should include an evaluation of existing maintenance requirements and development of landowner agreements where appropriate. Escapement monitoring cost are $41,878/project.
PeC-CCCS-24.1.5	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCCS-24.1.5.1	Action Step	Severe Weather Patterns	Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	100	FEMA, San Mateo County						0	This recommendation should be considered standard practice.
PeC-CCCS-24.1.6	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PeC-CCCS-24.1.6.1	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in San Mateo County.	2	5	CDFW, NMFS, San Mateo County						0	Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailor to general San Mateo County constraints. Costs may be higher if new guidelines are developed that do not rely on protocols from past studies.
PeC-CCCS-24.1.6.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalTrans, County of San Mateo, FEMA, Public, USACE						TBD	Particular attention should be directed in the lower portion of the watershed including Butano Creek. A sediment assessment for high-risk shallow seeded landside areas is needed to determine extent of erosion potential and protective measures.
PeC-CCCS-24.1.6.3	Action Step	Severe Weather Patterns	Establish targeted policies, requirements for sandy soils areas.	2	10	CalTrans, County of San Mateo, FEMA, Public, USACE						0	Extreme flood events such as those that occurred in 1955 could result in major input of sediment from upslope locations. Much of the lower watershed is comprised of highly erodible geology which would likely impact spawning and rearing habitats when sediment enters the stream channel. Improvements in land use practices will likely lower sediment yield rates following future flooding events. Action is considered In-Kind
PeC-CCCS-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										
PeC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of water quality conditions for rearing juvenile salmonids.	1	100	CDFW, County of San Mateo, State Parks, SWRCB						0	Aquatic conditions in Pescadero Creek are adversely affected by water diversions -- the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board. Water diversions adversely impact the summer lifestage by reducing flows and available habitat for rearing and feeding in the riverine areas as well as the estuary. Water diversions also extend the duration necessary for conversion to a freshwater lagoon during the summer. Work would entail SWRCB reviewing all existing water diversions and contacting diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to come into compliance. Initial focus should be directed at diversions in the Butano watershed. Action is considered In-Kind

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PeC-CCCS-25.1.2.1	Action Step	Water Diversion/ Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	2	10	CDFW, County of San Mateo, NMFS, POST, Private Landowners, San Mateo RCD, SWRCB						0	Site specific studies should be conducted to in ensure adequate instream flow targets are established for all life stages. Studies should include determining critical flow levels for stream reaches impacted by diversions, both future and current diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions would also be needed. The greatest numbers of water diversions are located in the lower watershed and in Butano Creek. Diversion in Butano Creek and its tributaries, coupled with degraded instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. Cost accounted for ensure water supply demands can be met.
PeC-CCCS-25.1.2.2	Action Step	Water Diversion/ Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential steelhead streams that go dry in some years	2	10	CDFW, County of San Mateo, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, SWRCB						TBD	Water diversions reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions. Initial focus to minimize the adverse effects of diversions should be focused in the Butano watershed. Completion of stream flow model will determine adequate conservation measures to insure adequate surface flows for steelhead.
PeC-CCCS-25.1.2.3	Action Step	Water Diversion/ Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	30	CDFW, County of San Mateo, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, SWRCB						TBD	In impacted areas, this recommendation should be a high priority. Cost will vary widely depending on willingness of water diverters to modify water diversions. Costs may be significant depending on site conditions and number of devices installed.
PeC-CCCS-25.1.2.4	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	3	5	CDFW, County of San Mateo, NMFS, SWRCB	74.00					74	This data base should already exist for the Pescadero Creek and costs to maintain it are likely minimal. These data should be used to guide future water availability studies. Cost based on stream flow/precipitation gauging at a rate of $74,195/project.
PeC-CCCS-25.1.2.5	Action Step	Water Diversion/ Impoundment	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	1	10	CDFW, County of San Mateo, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, SWRCB						TBD	Costs can be determined pending completion of evaluation of summer flows and impacts to historical hydrology from existing diversions.
PeC-CCCS-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration										
PeC-CCCS-25.1.3.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of migration patterns for listed salmonids in Pescadero Creek.	2	100	CDFW, County of San Mateo, NMFS, POST, Private Landowners, SWRCB						0	Action is considered In-Kind
PeC-CCCS-25.1.3.2	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFW, NMFS, POST, Private Landowners, SWRCB						0	This recommendation should be considered standard practice.
PeC-CCCS-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (impaired stream temperature)										
PeC-CCCS-25.1.4.1	Action Step	Water Diversion/ Impoundment	Request the SWRCB conduct interagency consultation with CDFW, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFW, NMFS, SWRCB						0	Action is considered In-Kind

Pescadero Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCCS-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PeC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Evaluate and monitor the streambed alteration program compliance related to all water diversions (CDFG 2004).	2	5	CDFW, POST, SWRCB	8.00					8	Cost is based on a one year pilot study. The study would evaluate rates of compliance and overall impact of currently permitted diversion to coho salmon and steelhead survival and recovery. This should be adopted as a standard practice by CDFW. However, full implementation may be limited due to a lack of staffing. In this circumstance, other alternatives should be evaluated.
PeC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	100	SWRCB						0	The greatest numbers of water diversions are located in the lower watershed and in Butano Creek. Diversion in Butano Creek and its tributaries, coupled with degraded instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. Action is considered In-Kind
PeC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	100	CDFW, County of San Mateo, NMFS, State Parks, SWRCB, USFWS						0	Action is considered In-Kind
PeC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Promote conjunctive use of water with water projects whenever possible to maintain or restore salmonid habitat.	2	100	California Coastal Conservancy, CDFW, County of San Mateo, Farm Bureau, NRCS, POST, Private Landowners, San Mateo RCD, SWRCB, Trout Unlimited						TBD	Costs will vary significantly depending on landowner cooperation, infrastructure constraints, and types of infrastructure necessary to meet landowner needs. Due to the predicted levels of flow impairment in the watershed it is likely that significant infrastructure and coordination will be required to meet minimum flow requirements for steelhead viability and therefore, costs will be significant.
PeC-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Enforce stream flow bypass requirements for diversions in Pescadero Creek and its tributaries.	1	100	CDFW, NMFS OLE, SWRCB						TBD	In time, bypass requirements may change due to findings from instream flow studies. Cost will be determined by minimum bypass flow requirements, landowner participation, and feasibility of implementing conservation measures.
PeC-CCCS-25.2.1.6	Action Step	Water Diversion/ Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	50	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
PeC-CCCS-25.2.1.7	Action Step	Water Diversion/ Impoundment	Encourage use of the most recent update of NMFS' Water Diversion Guidelines.	1	100	Coastside Land Trust, County of San Mateo, Farm Bureau, Private Landowners, San Mateo RCD, SWRCB						TBD	Cost associated with disseminating guidelines is minimal. Costs associated with use was not estimated.

Pilarcitos Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 1,100 adults
- Current Intrinsic Potential: 28.5 IP-km

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

Steelhead Abundance and Distribution

The Pilarcitos Creek watershed drains a 28-square-mile area encompassing seven subwatersheds: Nuff Creek, Corinda Los Trancos Creek, Apanolio Creek, Albert Canyon, Madonna Creek, Mills Creek, and Arroyo Leon. Pilarcitos Creek can be divided into three broad reaches: Upper Pilarcitos, above the confluence with seven tributaries; Middle Pilarcitos, primarily confined to an agricultural and residential floodplain valley; and Lower Pilarcitos, which flows through the City of Half Moon Bay (PWA 2008). In most years, Pilarcitos Creek is dry near the mouth and no summer lagoon forms.

Mainstem Pilarcitos Creek consists of approximately 12.8 stream miles of Class 1 watercourses. In 1985, DFG found about 7.5 miles of Pilarcitos Creek was available as spawning and rearing habitat (DFG 1985a, in Becker *et al.*, 2010). Stream substrate throughout the watershed is dominated by sand (PWA 1996). The abundance of sand, from erodible granitic and sandy soils, results in poor spawning conditions in much of the watershed (PWA 1996).

Old Stone Dam on Pilarcitos Creek, owned and operated by the San Francisco Public Utility Commission (SFPUC), blocks steelhead migration to historical IP habitat and is the upstream migration limit (Entrix 2006). In 1960, CDFW staff estimated the steelhead run in Pilarcitos Creek at 50 to 100 individuals (Entrix 2006). During the winter of 2011-12, CDFW conducted steelhead redd surveys at three reaches in the Pilarcitos Creek watershed including a 2.705 kilometer reach on the mainstem of Pilarcitos Creek, a 2.815 kilometer reach in Arroyo Leon, and a 0.884 kilometer reach in an unnamed tributary to Pilarcitos (Jankovitz 2012). Redds were observed in all three reaches: 3 redds (1.11 redds/kilometer) in Pilarcitos, 3 redds (1.07 redds/kilometer) in Arroyo Leon, and 1 redd (1.13 redds/kilometer) in the unnamed tributary. In addition, a total of 4 steelhead adults were observed (2 in Pilarcitos Creek and 2 in Arroyo

Leon). During the winter of 2012-13, only a small (0.51 kilometer) reach of the same unnamed tributary was sampled for redds; no redds or adult steelhead were observed (Jankovitz 2013).

Tributaries to Pilarcitos Creek, including Arroyo Leon, Mills, Madonna, Apanolio, Corinda Los Trancos, Albert Canyon, and Nuff Creeks, consist of approximately 21 stream miles. In the mid-1990s-early 2000s, multiple *O. mykiss* year classes were observed in all tributaries, except Madonna and Nuff Creeks where no *O. mykiss* have been observed (Becker *et al.*, 2010).

In November 1995, sampling by electrofisher yielded the following ranges of steelhead densities: 0-32 YOY fish/100 feet in Pilarcitos Creek; 0 YOY in Arroyo Leon; 12-37 YOY in Mills Creek, and 29 YOY in Apanolio Creek (PWA 1996). The ranges and observed densities for smolt-sized steelhead in Pilarcitos, Arroyo Leon, Mills, and Apanolio Creeks were: 0-22; 19; 10-26; and 23 fish/100 feet, respectively (PWA 1996). In 2000, 477 juvenile steelhead, which consisted primarily of YOY and age 1+ fish, were captured in two seasonal, on-channel reservoirs located in lower Arroyo Leon (Smith 2002). The reservoirs were filled in spring to capture stream flow for irrigation during the dry season and then drained in winter, usually with the first significant storm. Juvenile steelhead that reared in the reservoirs grew rapidly relative to steelhead that reared in upstream habitats. Smith (2002) concluded the reservoir-reared fish produced a significant portion of the smolts in the drainage and their larger size increased their survival at sea. Since 2001, the dams have remained drained due to multiple regulatory concerns including potential negative impacts on steelhead passage.

On Pilarcitos Creek, stream habitat and fish abundance generally increased upstream; the single sampled site on Apanolio Creek and the two lower sites on Mills Creek also had relatively high fish densities for the watershed (PWA 1996). Overall, under current conditions, Pilarcitos Creek watershed has only modest steelhead habitat compared to other streams in San Mateo County and Santa Cruz County (PWA 1996).

History of Land Use

The Pilarcitos Creek watershed consists primarily of relatively rugged uplands vegetated with shrubs and grasslands. The SFPUC owns a majority of the lands in the Upper Pilarcitos region and has stored water in two locations since 1910: Pilarcitos Lake behind Pilarcitos Dam, and a small, sediment-filled reservoir behind Old Stone Dam (PWA 2008). Below the dams, the watershed includes a mix of public and private lands, including agricultural areas. Public landowners include the Coastside County Water District, the City of Half Moon Bay, California State Parks, and the Sewer Authority Mid-Coastside. Substantial portions of the watershed are protected from urban development by the Peninsula Open Space Trust and State Parks.

Historically, upland portions of the watershed were cultivated for dry land crops, including small grains.

In 1992, failure of a debris dam downstream of the BFI Ox Mountain Landfill near Corinda Los Trancos Creek introduced massive amounts of sediment into Pilarcitos Creek. Downstream of the mainstem confluence with Corinda Los Trancos Creek, the sediment destroyed habitat by covering riffles and filling pools, and by creating a flat and shallow sandy substrate (PWA 1996).

Current Resources and Land Management

Approximately 400 acres of the floodplain and hillslope are cultivated for agriculture within the Pilarcitos Creek watershed (PWA 1996). Grazing, water diversions, and urbanization also occur in the watershed. The watershed is a source of drinking water for San Francisco Bay Area residents, and also supports recreational tourism. Residential land uses are present along Highway 92 and Pilarcitos Creek and along Higgins Canyon Road and Arroyo Leon. Major non-agricultural facilities in the watershed include a cemetery, a landfill, and a quarry (Todd Engineers 2003).

Public and private stakeholders have been intermittently working together since the mid-1990s as part of the Pilarcitos Creek Watershed Protection Project funded by CDFW and the San Francisco Regional Water Quality Control Board (SFRWQCB). The Pilarcitos Creek Advisory Committee (PCAC) was formed to advise CDFG and the SFRWQCB with the 1996 Pilarcitos Creek Restoration Project. In 1999, the San Mateo County Resource Conservation District became responsible for implementing the Restoration Project.

Members of the PCAC and other stakeholders formed the Pilarcitos Creek Restoration Workgroup (Workgroup) to implement restoration and management actions in the watershed. The Workgroup, with funding and support from SFRWQCB and SFPUC, is developing an Integrated Watershed Management Plan (IWMP). The stated goal of the IWMP is to restore steelhead and other native plant and animal species in the riparian community while minimizing potential impacts to public health, water supply, and other beneficial uses and economic interests.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: estuary, floodplain connectivity, hydrology, passage, habitat complexity, riparian vegetation, sediment transport,

and water quality. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

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

Population and Habitat Conditions

Estuary: Quality & Extent

Outside of the San Francisco Bay, the Pilarcitos lagoon is one of the most impacted lagoon within the range of steelhead. Within the Santa Cruz Mountains Diversity Stratum, the Pilarcitos lagoon is the only lagoon within an anadromous population known to go completely dry during the summer period (Ambrose, pers. obs. 2001). Pilarcitos lagoon also lacks residual depth in spring, which significantly reduces or eliminates essential habitat for smolts where they can feed and acclimate to saltwater prior to entry to the ocean (PWA 2008). Lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond *et al*., 2008; Smith 1990). The drying of the lagoon during the summer months and lack of residual depths in spring are significant limiting factors to the steelhead population in Pilarcitos Creek.

Passage/Migration: Mouth or Confluence and Physical Barriers

Most fish passage impediments occur upstream of the confluence with Albert Canyon and mainstem Pilarcitos Creek. The upper mainstem area has two dams owned and operated by the City of San Francisco. The lower dam, known as Old Stone Dam, blocks access to 2.3 miles of potential spawning and rearing habitat. The SFPUC is aware of the impediment that the two dams present to steelhead passage through extensive correspondence with NMFS' Office of Law Enforcement and North Central Coast Office staff. Old Stone Dam is a 15 AF reservoir that is essentially full of sediment. The primary use of Old Stone Dam is not to hold water, but rather to act as a diversion facility to divert water from the Pilarcitos watershed into Lower Crystal Springs Reservoir, which is operated by the San Francisco Water Department. Above Old Stone Dam is Pilarcitos Reservoir, at the headwaters of Pilarcitos Creek, with a capacity of 3,091 AF.

Smaller passage impediments are located on Apanolio and Arroyo Leon Creeks. These impediments consist of instream diversion dams used for agriculture. The dams on Arroyo Leon are currently non-operational and are believed not to pose a significant constraint to upstream migration.

Riparian Vegetation: Composition, Cover & Tree Diameter

Altered riparian conditions are common throughout much of the Pilarcitos Creek watershed, arising largely from urban and agricultural encroachment into riparian corridors and the intentional and unintentional establishment of non-native vegetation in the riparian zone. Exotic plants that were introduced for landscaping dominate the valley floors, yet native species are still relatively common in riparian areas, especially in the upper reaches. The health and diversity of riparian species deteriorate downstream due to the spread of invasive ornamentals. Altered riparian areas change tree recruitment rates and the quality of instream habitat forming features.

Sediment Transport: Road Density

High levels of instream fine sediment and turbidity likely impair steelhead spawning and rearing success within the Pilarcitos Watershed. Pilarcitos Creek is considered impaired by high instream sediment conditions; A.A. Rich and Associates (1994) documented poor salmonid spawning substrate conditions throughout the watershed. PWA (1996) reported sediment yield estimates (from other studies) for Pilarcitos Creek that ranged from 425 tons/square mile/year in one study with another study estimating sediment yield ranging between 80 and 5,570 tons/square mile/year. PWA (2008) reported information from other studies indicating the two primary sources of sediment are from Apanolio Creek and the Upper Pilarcitos Creek below Old Stone Dam. Sources contributing to the altered sediment transport include agricultural and road-related erosion.

Water Quality: Turbidity or Toxicity

Steelhead survival within Pilarcitos Creek is likely poor due to impaired water quality. PWA (1996) noted there were little data available on water quality; however, predicted pollutants may include leachate from the Ox Mountain Landfill, fertilizers and pesticides used for agriculture, and hydrocarbons and heavy metals from highways and roads. According to PWA (2008), water quality monitoring by the San Mateo County Public Health and Environmental Protection Division and Monterey Bay Sanctuary Citizen Watershed Monitoring Network (Network) show consistently high fecal coliform counts compared to other coastal streams. The Network data also indicate trace metals, nitrates, and suspended sediment concentrations were elevated periodically from 2003 to 2006. Estuarine water quality is further impaired from

equestrian use in the upper reaches of the estuary where trails used by horseback riders are present.

Velocity Refuge: Floodplain Connectivity

The dysfunctional riparian habitat present today in the Pilarcitos watershed is primarily due to poor agricultural practices, urbanization, and the associated effects of channel confinement and altered hydrology, which have caused widespread riparian encroachment, channel degradation, and floodplain/stream channel disconnection. The overall degraded condition is expected to persist in the watershed.

Hydrology: Baseflow and Passage Flows

According to PWA (1996), streamflow in Pilarcitos Creek is reduced by dam and water diversions and groundwater pumping adjacent to the creek. Low flows can degrade fish habitat and impede adult and juvenile migration. During dry years, there is not enough flow to transport even fine sand from the various creeks in the watershed. As a result, pools fill in and the coarser substrate is buried. Losing these habitats reduces rearing space and degrades food production areas. Within Pilarcitos Creek, the issues of water use and streamflow are complicated by the number of water users, the questionable legality of the various water diversions, the economics and politics related to water use, and the lack of coordination between users.

PWA (2008) reported that the impacts from hydro-modification are likely greatest in Lower Pilarcitos and Corinda Los Trancos. Increasing residential development in Half Moon Bay increases the impervious surface area in the lower watershed, increasing the amount of runoff. Lower Pilarcitos is particularly susceptible to impacts from hydro-modification because of local geological conditions that lead to predominantly sand as the main channel substrate.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Major landscape disturbance within the Pilarcitos system is associated with agricultural development along the Pilarcitos Creek mainstem and urbanization concentrated around the Pilarcitos/Arroyo Leon confluence. The steeper upper portions of the watershed are relatively undisturbed, except for the Ox Mountain landfill located above Corrinda Los Trancos Creek.

Habitat Complexity: Large Wood and Shelter

Stream substrate throughout the watershed is dominated by sand, even at the best locations (PWA 1996). Sand dominates the substrate composition of pools and runs, limiting pool extent and depth and aquatic insect abundance. Substrate conditions, combined with a lack of instream structure in Pilarcitos, significantly impair summer rearing and overwintering

conditions. Wood that enters the channel and acts to form instream structure is routinely removed by streamside residents. PWA (1996) reported that stream bank erosion is pervasive throughout the watershed due to channel incision. Channel incision and subsequent bank erosion has led to increased bank hardening that impairs undercut bank formation and limits growing space for riparian vegetation.

Viability: Density, Abundance, and Spatial Structure

As discussed previously in within the *Steelhead Abundance and Distributions* section, the density and abundance of steelhead within the Pilarcitos Creek population area are reduced from historical estimates. However, small numbers of steelhead continue to persist throughout most tributaries.

Threats

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

Agriculture

Approximately 400 acres of floodplain and hillslope are cultivated for agriculture within the Pilarcitos Creek watershed (PWA 1996). Topsoil eroded from farmed areas by sheet erosion is transported into Pilarcitos Creek. Agricultural land is located immediately adjacent to much of mainstem Pilarcitos Creek, and riparian buffers, in many locations, are severely limited in quality and width. In these areas, sediment contribution from agricultural practices is likely very high. Agricultural practices may also degrade water quality in the creek due to the use of various herbicides and pesticides.

Channel Modification

Bank erosion rates increase where riparian vegetation has been removed for agricultural land reclamation (PWA 1996). Bank stabilization practices, which lock the stream channel in place, are commonly used in Pilarcitos Creek to prevent the stream channel from meandering. In Pilarcitos Creek, stream bank stabilization and channelization measures have simplified instream habitat complexity and disconnected some stream channels from their floodplains. PWA (1996) documented a major shift in channel morphology in Pilarcitos Creek from 1943-1980 as evidenced by loss of channel sinuosity. Channel meanders present in 1943 were straightened for agricultural reclamation by 1956, and these locations are now experiencing bank erosion as the channel attempts to re-establish a natural meander pattern. As a result of

channel modification, riparian condition throughout urbanized and agricultural portions of the watershed is generally poor, with lower densities of shade producing trees and a higher proportion of non-native species.

Disease/Predation/Competition

Exotic vegetation is present throughout many of the stream reaches in Pilarcitos Creek. PWA (1996) reported invasive non-native plant species were displacing and out-competing native vegetation in most areas of the watershed. Of particular concern were infestations of eucalyptus, German ivy, pampas grass and French broom. German ivy is considered the most invasive and problematic species in the riparian corridors of the watershed. German ivy has spread throughout much of the watershed and is especially prevalent along Pilarcitos Creek and Arroyo Leon.

Residential and Commercial Development

The 2010 census estimated the population within Pilarcitos Creek at over 5,701 individuals. Fifteen percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2015), with the majority of the development located in the lower portion of the watershed or along the mainstem of Pilarcitos Creek. This proximity of residential development is indicative of a modified stream system and impaired instream conditions. The level of development has increased the impervious surface area within the watershed, impacting hydrology as well as the pollutant level within the aquatic environment, and impairing instream conditions (passage, instream habitat, hydrology, and floodplain connection) necessary for the support of a robust steelhead population.

Sediment Transport: Road Density

Road networks within the Pilarcitos watershed are largely paved systems associated with urban development, rather than the large unpaved systems common to other watersheds with high levels of logging and rural growth. As a result, much of the impact resulting from roads relates to road-borne pollution (e.g., oils, urban runoff, etc.) in addition to sediment from road maintenance practices and their direct delivery into the aquatic system. Furthermore, paved roads represent a significant portion of the total impervious surface within the basin, and likely influence storm flow intensity and duration during winter. Paved and some unpaved roads parallel many of the waterways within Pilarcitos Creek and impinge on channel migration. The headwaters of upper Pilarcitos Creek are relatively rural in nature and are characterized by low to moderate road densities. Road densities are lowest in upper Pilarcitos on lands owned and managed by the City of San Francisco.

Severe Weather Patterns

Drought conditions within the Pilarcitos Creek watershed may exacerbate low summer flows already strained by existing water diversions and groundwater pumping. Lower Pilarcitos is typically dewatered 59 days per year on average (PWA 1996), and during a severe drought, the amount of creek dewatered would likely increase significantly.

Extreme rainfall events could transport significant sediment from upslope locations into the stream environment. The watershed is comprised of highly erodible geology. When eroded and deposited in stream channels, the fine sediment likely impacts steelhead spawning and rearing habitats. Changing and improving land use practices could lower sediment yield rates following future flooding events. However, most of the instream habitat in the watershed is currently considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions.

Water Diversion and Impoundment

Aquatic conditions in Pilarcitos Creek are adversely affected by water management operations. These water management operations block steelhead passage, limit migration periods, and alter hydrology and instream habitat, and are likely the most significant limiting factor for salmonids in the watershed. Diversions by the City of San Francisco and others in the upper portion of the watershed, in combination with pumping of the aquifer from streamside wells, significantly reduce streamflow and de-water summer rearing habitat for juvenile steelhead. In upper Pilarcitos, there is a concentration of many large diversions that impair downstream habitat including some of the best potential rearing habitat in the upper watershed. Lower Pilarcitos Creek is dry on average 59 days of the year, and flows are often too low to transport fine sediment out of the system (PWA 1996). In Arroyo Leon diversions are concentrated in the lower portion of the watershed, allowing sufficient summer rearing habitat to persist in upper Arroyo Leon and Mill Creek.

The impact of diversions is significant to both the flowing stream as well as the estuary. Properly functioning estuaries can provide exceptional growth and rearing conditions for juvenile steelhead (Smith 1990, Bond *et al*., 2008). The Pilarcitos estuary is the only estuary utilized by steelhead between the Golden Gate and Salinas River estuary known to go completely dry in most summers, and the source of the desiccation is believed to be due to upstream water diversions and diversion from streamside wells.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests threats impacting juvenile, smolt, and adult lifestages are likely most limiting steelhead productivity in the Pilarcitos Creek watershed. Water quantity is inadequate for a significant proportion of the stream reaches historically supporting steelhead, and is largely a result of direct and near stream water diversions that reduce or eliminate migration, spawning, and rearing opportunities. Additionally, migration, spawning, and rearing habitats are poor throughout most of the year within the channelized stream reaches and estuary, as a result of poor canopy cover (elevated water temperatures), high rates of sediment input (reduced pool volumes and feeding areas) and urban/agricultural effluent entering the aquatic environment (excess macrophyte growth and increased toxin load). Adults and smolts likely encounter poor migratory habitat (e.g., little holding pools, excess flow velocity) throughout the same channelized mainstem reaches.

General Recovery Strategy

Passage Above Old Stone Dam

The stream habitat located above Old Stone Dam historically provided steelhead spawning and rearing habitat. The habitat above Old Stone Dam to Pilarcitos Reservoir is filled with high levels of fine sediment but this could likely be flushed downstream with dam removal and higher flow releases from Pilarcitos Reservoir. Facilitating sediment transport could improve spawning conditions below Old Stone Dam where the channel is entrenched and adequate spawning habitat is limited due to sediment retention at the dam.

Reservoir Operation to Benefit all Lifestages of CCC Steelhead

Pilarcitos Reservoir should be operated in such a manner as to benefit all steelhead lifestages in Pilarcitos Creek. Considerations should include, but not be limited to, water temperature, flow velocity, ramping rates (as necessary to prevent scour of eggs, or displacement or stranding of juveniles), sediment transport, channel maintenance, instream habitat maintenance, and adult and smolt migratory cues. Upper Pilarcitos Creek is relatively intact, and focused actions to improve habitat conditions could provide significant refugia habitat for steelhead rearing. Prioritizing restoration actions in this stream reach could serve as a bridge to ensure steelhead persist in the watershed while other longer term recovery actions in the lower watershed are initiated and take effect.

Minimize Diversions and Diversion Effects

Diversions, both from near stream wells and from Pilarcitos Reservoir, adversely impact all steelhead lifestages. No further studies are needed to document the effects of diversion operations downstream of the reservoir. Any future studies should establish minimum flow

requirement for all salmonid lifestages in Pilarcitos Creek. Additional efforts should be directed at coordinating water diversions by all water users, using other sources of water for agricultural operations (such as tertiary treated waste water), and minimizing diversion out of the watershed into Crystal Springs Reservoir (San Mateo Creek watershed).

Address Channelization to Improve Habitat Fragmentation

The distribution of properly functioning aquatic habitat within the watershed is interrupted/disconnected by urban and agricultural land disturbance. The lower and middle portion of the watershed is impacted by urbanized landscapes and channelized stream reaches, which offer little functional habitat for migrating, rearing or spawning steelhead. Reconnecting existing floodplain habitat within select sections of these streams would re-establish a critical limiting factor which would benefit all steelhead lifestages.

Improve Riparian Function and Composition

Poor riparian habitat is likely limiting steelhead productivity throughout many sections of the Pilarcitos Creek watershed. Improving riparian habitat function and composition by out-sloping channelized stream banks (widening riparian zones), removing exotic vegetation, and planting native species would improve canopy cover and water quality, and ultimately improve LWD recruitment and the volume of wood-related cover in the stream channel.

Improve Instream Habitat Quality and Quantity

Addressing riparian conditions alone is unlikely to solve the poor instream habitat conditions prevalent throughout much of the watershed. While improved riparian function will increase wood recruitment into streams to some extent in the future, the degree of urban and agricultural interface present within the Pilarcitos Creek watershed, and the effect this interface has on recruitment of wood from upslope sources, suggests that further restoration measures will be required to fix the current scenario. Recovery actions should focus on improving spawning habitat through gravel augmentation projects; standard log/boulder habitat structures can effectively increase holding and rearing habitat.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a common problem throughout the watershed. Restoration actions should focus on identifying and prioritizing current sediment sources within the basin. High priority sites should receive initial restoration funding.

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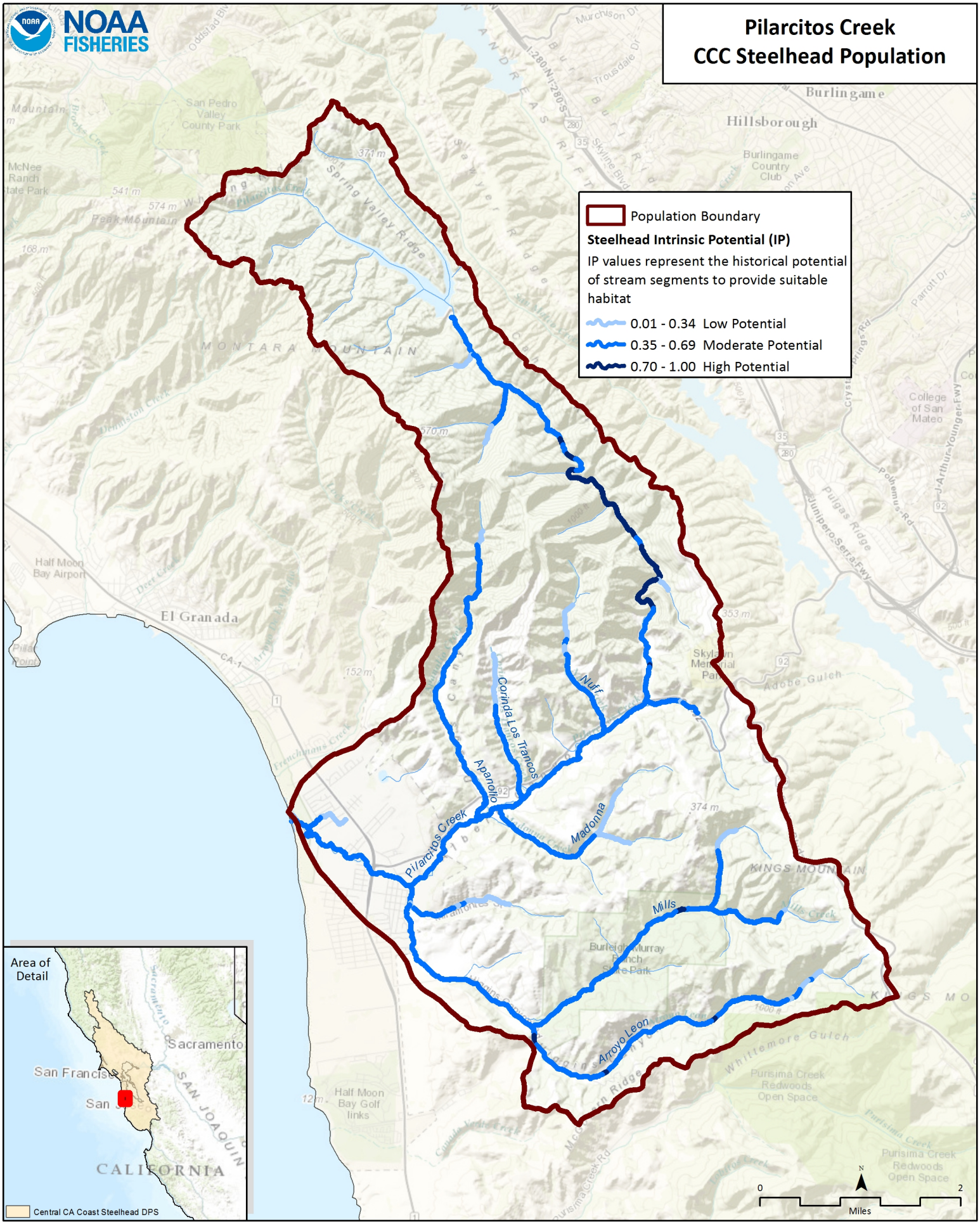
Pilarcitos Creek
CCC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Pilarcitos Creek
Madonna
Corinda Los Trancos
Aparicio
Nuff
Mills
Arroyo Leon
Area of Detail
Sacramento
San Francisco
San Jose
CALIFORNIA
Central CA Coast Steelhead DPS
Miles

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100m)	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/100m)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			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	73% of historical IP currently accessible	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		
			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	?69% Density rating "D" across IP-km	Poor

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		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)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100m)	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/100m)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km 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	73% of historical habitat accessible	Fair

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	54% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<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/100m)	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/100m)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			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	73% of historical IP-km currently accessible	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		
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

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

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	2.6% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	>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	>21% 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	25-50% 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	1.7 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

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

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
PilC-CCCS-1.1.1.1	Action Step	Estuary	Work with the SWRCB to identify and bring into compliance all unpermitted and out of compliance water diversions in the watershed.	1	100	Private Landowners, SWRCB						0	Investigation should include all diversions from wells that are connected to flows from surface water diversions. Action is considered In-Kind
PilC-CCCS-1.1.1.2	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	10	CDFW, Coastside County Water District, Farm Bureau, NMFS, Private Landowners, SWRCB						0	Action is considered In-Kind
PilC-CCCS-1.1.1.3	Action Step	Estuary	Encourage State Parks to construct an equestrian crossing or reroute equestrian trails away from the lagoon.	3	10	State Parks						0	State Parks has received written correspondence from NMFS regarding concerns over adverse impacts to water quality resulting from at least one equestrian crossing on Pilarcitos lagoon. See Recreational Areas and Activities for a cost estimate.
PilC-CCCS-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
PilC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.	2	100	Coastside County Water District, County of San Mateo, Private Landowners						0	Action is considered In-Kind
PilC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	100	Coastside County Water District, County of San Mateo, Private Landowners						0	Action is considered In-Kind
PilC-CCCS-2.1.1.3	Action Step	Floodplain Connectivity	Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.	2	100	Coastside County Water District, County of San Mateo, POST, Private Landowners, San Mateo RCD, SFPUC						TBD	Conservations are generally preferable to fee title purchase. Conservation easements allow protection of key portions of landscapes at significantly less cost than purchasing. Cost cannot be estimated due to the wide range of value for individual landscapes and wide variation between costs between the two methods. NMFS (2008) estimated costs for conservation easements could range from $223 per acres to $65000 per acre depending on location. Cost of land with medium to high development potential can range 23,256 per acre to unpredictable upper limits depending on location for purchase. Cost will vary highly depending market value, rate of turnover, and landowner willingness.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-2.1.1.4	Action Step	Floodplain Connectivity	Initiate assessment of these habitats in the watershed and prioritize according to development risk and habitat condition and function.	2	10	Coastside County Water District, County of San Mateo, Farm Bureau, POST, San Mateo RCD, Sewer Authority Mid-Coastside, SFPUC	42.00	42.00				84	Cost based on riparian restoration at a rate of $84,124/project. Costs assume the hiring of a consultant to evaluate historical information sources and conduct a review of existing aerial photographs (or other imagery). Some ground truthing will likely be required.
PilC-CCCS-2.1.1.5	Action Step	Floodplain Connectivity	Minimize future urban development in floodplains or offchannel habitats	1	100	County of San Mateo, FEMA, USACE						0	Maintenance of the ecological function provided by these areas is very important to maintaining water quality and the overall viability of the remaining Pilarcitos steelhead population. Very few of these areas likely remain in a functional and undeveloped state in the watershed. Protection of these remaining areas can serve as a nucleus for expanding future restoration actions designed to enhance, restore, and create these important habitat features. Action is considered In-Kind
PilC-CCCS-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
PilC-CCCS-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	10	CDFW, City of Half Moon Bay, Farm Bureau, POST, Private Landowners, SFPUC, SWRCB, Trout Unlimited						0	Promoting these type of projects will require a sustained effort to target willing landowners in critical stream reaches. Cost estimate is not for actual permitting and construction cost. Cost estimate (In-Kind) applies to working with landowners, water rights holders, and regulatory agencies in order to develop the appropriate template for the Pilarcitos Creek watershed.
PilC-CCCS-3.1.1.2	Action Step	Hydrology	Promote conjunctive use of water whenever possible to maintain or restore steelhead habitat.	2	40	City of Half Moon Bay, Coastside County Water District, Farm Bureau, POST, Private Landowners, SWRCB						0	Highlighting these issues will likely require the development of MOAs between water users. Action is considered In-Kind
PilC-CCCS-3.1.1.3	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead throughout the watershed.	2	10	CDFW, Coastside County Water District, Farm Bureau, NMFS, POST, Private Landowners, San Mateo RCD, SWRCB	75.00	75.00				150	Some efforts have been made by SFPUC to evaluate instream flow requirements in the upper reaches of Pilarcitos below Old Stone Dam. This information can be leveraged in a larger watershed wide evaluation. Cost based on stream/flow precipitation gauging at a rate of $74,195/project
PilC-CCCS-3.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
PilC-CCCS-3.2.1	Recovery Action	Hydrology	Improve flow conditions										

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-3.2.1.1	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	20	CDFW, NMFS, RWQCB, SWRCB						0	Action is considered In-Kind
PilC-CCCS-3.2.1.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition for change of use (1707).	2	100	CDFW, Coastside County Water District, Farm Bureau, POST, Private Landowners, San Mateo RCD, SFPUC, SWRCB						TBD	Costs will vary widely depending on quantity of water converted to instream use. Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach should occur over the entire 100 year recovery horizon.
PilC-CCCS-3.2.2	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
PilC-CCCS-3.2.2.1	Action Step	Hydrology	Work with partner agencies so that patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	20	CDFW, NMFS, RWQCB, SWRCB						0	Action is considered In-Kind
PilC-CCCS-3.2.2.2	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.	1	10	CDFW, NMFS, POST, San Mateo County, SFPUC, SWRCB						0	Action is considered In-Kind
PilC-CCCS-3.2.2.3	Action Step	Hydrology	Work with SWRCB and landowners to maintain or re-establish natural flow regimes for smolt migration if determined to be limiting during all water years.	3	20	CDFW, NMFS, POST, Private Landowners, SFPUC, SWRCB						0	Identify critical passage areas and modeling of potential flow solutions during April and May to ensure smolts are able to access the ocean. Likely most limiting during drought periods. Action is considered In-Kind
PilC-CCCS-3.2.2.4	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	Coastside County Water District, NMFS, POST, SWRCB						0	See estuary strategies for estimates of cost in Pilarcitos. Initial focus should be directed at wells located in the lower portion of the watershed (such as golf course wells adjacent to the estuary). Action is considered In-Kind
PilC-CCCS-3.2.2.5	Action Step	Hydrology	Request SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters.	2	100	CDFW, Coastside County Water District, County of San Mateo, Farm Bureau, NMFS, POST, Private Landowners, SFPUC, SWRCB						0	The SWRCB should be solicited as quickly as possible. The 100 year duration indicates that this program should continue throughout the life of the recovery plan. Initial focus should be directed at water releases below Old Stone Dam. Action is considered In-Kind
PilC-CCCS-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
PilC-CCCS-5.1.1.1	Action Step	Passage	Develop a sediment budget and evaluate the best alternative for addressing sediment behind Old Stone Dam.	2	3	CDFW, NMFS, RWQCB, SFPUC						TBD	TBD, costs difficult to determine without a sediment assessment conducted and development of alternatives for addressing sediment. Estimated cost is likely much higher than would be necessary if landowner willingly agreed to initiate removal of Old Stone Dam. Little infrastructure is present in the three mile stream reach below the dam.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-5.1.1.2	Action Step	Passage	Remove Old Stone Dam.	2	5	CDFW, NMFS, RWQCB, SFPUC	1,562					1,562	Cost estimated at $1,561,591/project for unknown height, complete barrier. It is likely that the dam could be removed for significantly less than predicted if the landowner agrees and is proactive regarding this recommendation. SFPUC, to date, has been unwilling to remove the dam despite the significant benefits to the steelhead fishery that would likely result.
PilC-CCCS-5.1.2	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)										
PilC-CCCS-5.1.2.1	Action Step	Passage	Reconstruct lower vortex weir on Arroyo Leon just upstream from Mills Creek confluence.	3	5	CDFW, NMFS, Private Landowners, San Mateo RCD	119.00					119	Project will entail replacing dislodged boulders and constructing a more stable grade control structure downstream of a driveway weir. Cost based on treating one site at a rate of $118,560. It is assumed the cost of replacing would be equivalent to implementing an ELJ.
PilC-CCCS-5.1.2.2	Action Step	Passage	Remediate passage conditions at the Mills Creek Historic Bridge.	3	5	CDFW, County of San Mateo, NMFS, San Mateo RCD, State Parks	412.00					412	Modifications at this site will provide adult steelhead passage past the historic bridge to at least one mile of spawning and rearing habitat upstream (PWA 2008). Cost based on providing passage for a stream in an urban area at a rate of $411,519/project.
PilC-CCCS-5.1.2.3	Action Step	Passage	Remediate passage barriers on Apanolio Creek.	3	5	CDFW, Corps, NMFS	486.00					486	An evaluation of the upstream habitat should be initiated prior to any additional analysis regarding passage at this site. Numerous efforts to conceptually address adult passage have already occurred in this watershed. Implementation of these efforts has not been successful due to a variety of issues, including landowner concerns over water rights. Additional efforts should carefully weigh the relative benefits to expending additional time and effort in Apanolio compared to other more pressing issues adversely affecting the steelhead fishery in the watershed. Cost based on providing passage on a tributary stream in a suburban area at a rate of $485,827/project.
PilC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings										
PilC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Identify historical salmonid habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.		5	San Mateo RCD, State Parks	131.00					131	Cost based on fish/habitat restoration monitoring at a rate of $130,941/project.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	20	CDFW, Coastside County Water District, County of San Mateo, Farm Bureau, POST, Private Landowners, San Mateo RCD, SFPUC	148.25	148.25	148.25	148.25		593	Stream surveys are required in order to determine areas and quantity and types of enhancement structures necessary to obtain properly functioning instream conditions for complexity. Costs will vary depending on types of structures installed. NMFS (2008) estimated costs of LWD placement can range from $37,500 (at 20 structures per mile) to $221,932 (400 structures per mile). It is likely the number of structures placed in Pilarcitos would be modest but it is also reasonable to assume the costs would be high because the structures would be engineered. Cost based on treating 1 mile (assume 50% high IP) at a rate of $118,560/ELJ. Assume a minimum of 5 ELC/mile.
PilC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Allow native trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	Coastside County Water District, County of San Mateo, Farm Bureau, POST, Private Landowners, SFPUC						0	This recommendation will likely be high controversial along the lower mainstem of Pilarcitos Creek due to the intensive agricultural and residential development along the riparian corridor.
PilC-CCCS-6.1.1.4	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	2	60	County of San Mateo, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Initiate stream surveys according to CDFW habitat typing protocol.	2	3	CDFW, Coastside County Water District, Farm Bureau, POST, San Mateo RCD, Sewer Authority Mid-Coastside, SFPUC	131.00					131	Cost based on conducting fish/habitat restoration monitoring at a rate of $130,941
PilC-CCCS-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-7.1.1	Recovery Action	Riparian	Improve canopy cover										
PilC-CCCS-7.1.1.1	Action Step	Riparian	Encourage the cultivation and availability of locally indigenous riparian plants for use in restoration and bank stabilization.	3	100	CDFW, Corps, County of San Mateo, Farm Bureau, POST, RWQCB, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-7.1.1.2	Action Step	Riparian	Target Cape Ivy in the lower portion of the watershed for removal.	3	10	County of San Mateo, Farm Bureau, POST, Private Landowners, San Mateo RCD	39.50	39.50				79	Ivy removal will likely require a sustained long term effort in order to control its spread in the watershed. Cost based on treating 1 mile (assume 5% high IP with a minimum of 1 mile and 80acres/mile) at a rate of $984/acre.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-7.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers. Work cooperatively with land trusts, and San Mateo RCD to establish conservation easements, setbacks, and riparian buffers on agricultural areas and urban areas.	2	100	County of San Mateo, POST, San Mateo RCD, SFPUC						0	Action is considered In-Kind
PilC-CCCS-7.1.1.4	Action Step	Riparian	Encourage development and implementation of a program similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	20	County of San Mateo	12.25	12.25	12.25	12.25		49	Cost based on treating 0.36 miles (assume 15% of high IP with 80acres/mile) at a rate of $1673/acre.
PilC-CCCS-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										
PilC-CCCS-11.1.1.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	3	20	CDFW, Coastside County Water District, County of San Mateo, POST, Sewer Authority Mid-Coastside, SFPUC, State Parks							Assessment methods should comport to those in the Coastal Monitoring Program. Assumption that surveys would be episodic based on a regional 10 percent sampling design (GTRS) consisting primarily of redd surveys. Cost accounted for in Monitoring Chapter.
PilC-CCCS-12.1	**Objective**	**Agriculture**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance										
PilC-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 recovery priorities.	3	100	Coastside County Water District, Farm Bureau, NRCS, Private Landowners, San Mateo RCD, SFPUC						0	Action is considered In-Kind
PilC-CCCS-12.1.1.2	Action Step	Agriculture	Promote agricultural practices that protect and restore CCC steelhead habitat by working with the agricultural community.	2	100	NRCS, RWQCB, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-12.1.1.3	Action Step	Agriculture	Minimize future agricultural development and promote agricultural practices on existing activities that protect and restore habitats for CCC steelhead.	1	100	County of San Mateo, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-12.1.2	Recovery Action	Agriculture	Prevent alterations to sediment transport (road condition/density, dams etc.)										
PilC-CCCS-12.1.2.1	Action Step	Agriculture	Encourage the NRCS, RCDs, and other appropriate organizations to increase the number of landowners participating in sediment reduction planning and implementation.	2	100	Coastside County Water District, County of San Mateo, Farm Bureau, NRCS, San Mateo RCD, State Parks						0	Action is considered In-Kind

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-12.1.2.2	Action Step	Agriculture	Complete Farm Conservation Plans that address sediment source reduction, riparian habitat, forest health, and restoration.	3	30	County of San Mateo, Farm Bureau, NRCS, POST, San Mateo RCD, SFPUC						TBD	Cost will depend on the number of participants. A Farm Conservation Plan is estimated to cost 5k-20k.
PilC-CCCS-12.1.2.3	Action Step	Agriculture	Work with landowners to assess and address erosion control measures throughout the winter period.	2	100	NRCS, RWQCB, San Mateo RCD						TBD	This effort is anticipated to occur over the life of the recovery plan. Most costs will be incurred early on and will likely decrease once landowners adopt appropriate erosion control measures. It is anticipated that the majority of the implementation costs will be borne by the landowners.
PilC-CCCS-12.1.2.4	Action Step	Agriculture	Continue the use of cover crops in agriculture fields.	3	100	Farm Bureau, NRCS, RWQCB, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-12.1.2.5	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	Caltrans, City of Half Moon Bay, County of San Mateo						TBD	Properly sized riparian buffers will result in significant improvements to instream conditions. This recommendation should continue into perpetuity.
PilC-CCCS-12.2	**Objective**	**Agriculture**	**Address the inadequacies of existing regulatory mechanisms**										
PilC-CCCS-12.2.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance										
PilC-CCCS-12.2.1.1	Action Step	Agriculture	Promote adequate monitoring and enforcement of existing conservation easements in the watershed to ensure compliance with stated easement goals and habitat targets.	3	100	Land Trusts, POST						0	No costs are anticipated. Most conservation easement have an establish endowment to address costs associated with monitoring of easements.
PilC-CCCS-12.2.1.2	Action Step	Agriculture	Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	3	50	Landtrusts, Private Landowners						TBD	Cost cannot be determined because of the variability in market value, frequency of turnover, and landowner willingness.
PilC-CCCS-12.2.1.3	Action Step	Agriculture	Discourage San Mateo County from rezoning designated open space to other land uses.	3	20	NMFS, County of San Mateo						0	Action is considered In-Kind
PilC-CCCS-12.2.1.4	Action Step	Agriculture	Coordinate with the agencies that authorize conversions to discourage conversion of open space.	2	100	City of Half Moon Bay, County of San Mateo, POST						0	Action is considered In-Kind
PilC-CCCS-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology										
PilC-CCCS-13.1.1.1	Action Step	Channel Modification	Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.	1	20	County of San Mateo, NMFS, San Mateo RCD	850	850	850	850		3,400	Cost based on treating 1 mile (assume 1 project per mile in 25% high IP with a minimum of 1 mile with 80acres/mile) at a rate of $42,408/acre
PilC-CCCS-13.1.1.2	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.	3	100	City of Half Moon Bay, County of San Mateo, POST, Private Landowners, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-13.1.1.3	Action Step	Channel Modification	Avoid or minimize the effects of flood control project on steelhead habitat.	1	100	City of Half Moon Bay, Corps, County of San Mateo						0	Action is considered In-Kind

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-13.1.1.4	Action Step	Channel Modification	Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.	3	100	Caltrans, City of Half Moon Bay, Corps, County of San Mateo, NRCS, POST, SFPUC						TBD	Cost cannot be determined without an assessment of the number of obsolete bank stabilization structures and will likely vary highly between individual projects.
PilC-CCCS-13.1.1.5	Action Step	Channel Modification	For riparian roads, promote road relocation as a preferred alternative to bank stabilization.	2	100	Caltrans, County of San Mateo, Farm Bureau, San Mateo RCD						TBD	Costs cannot be determined at this time. Relocation may result in a cost savings over time due to reduced needs for bank stabilization. However, initial costs may be prohibitive in many areas where extensive urban infrastructure is present.
PilC-CCCS-13.1.1.6	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	Caltrans, City of Half Moon Bay, Coastside County Water District, County of San Mateo, NRCS, POST, Private Landowners, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-13.1.1.7	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.	1	100	Caltrans, CDFW, City of Half Moon Bay, County of San Mateo, NRCS, POST, San Mateo RCD, Santa Clara Valley Water District, SFPUC						0	Action is considered In-Kind
PilC-CCCS-13.1.1.8	Action Step	Channel Modification	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.	2	5	City of Half Moon Bay, Corps, County of San Mateo, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-13.1.1.9	Action Step	Channel Modification	Discourage stabilization projects which will lead to additional instability either up- or downstream.	2	100	Caltrans, CDFW, City of Half Moon Bay, Coastside County Water District, Farm Bureau, NRCS, POST, RWQCB, San Mateo RCD, Sewer Authority Mid-Coastside, SFPUC, State Parks						0	Action is considered In-Kind
PilC-CCCS-14.1	**Objective**	**Disease /Predation /Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-14.1.1	Recovery Action	Disease /Predation /Competition	Prevent or minimize reduced density, abundance, and diversity										

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-14.1.1.1	Action Step	Disease /Predation /Competition	Identify the extent of eucalyptus and the consequences of removing stands.	3	10	County of San Mateo, NMFS, San Mateo RCD						TBD	Cost likely accounted for in action step below.
PilC-CCCS-14.1.1.2	Action Step	Disease /Predation /Competition	Initiate eucalyptus removal in areas where benefits to properly functioning conditions are anticipated.	3	10	Coastside County Water District, County of San Mateo, POST, San Mateo RCD, SFPUC, State Parks	67.00	67.00				134	Many of the stands in the watershed are well established. Removal will likely require significant community outreach. Eucalyptus control and planning was recommended in the Pilarcitos Integrated Watershed Management Plan. NMFS estimated costs for site preparation can range from $17,442 per acre to $1,366,279 per acre. Cost estimated for treating 1.2 miles (assume 50% high IP) at a rate of $1,658/acre.
PilC-CCCS-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PilC-CCCS-21.1.1.1	Action Step	Recreation	Recreational trails should be set back from the creek and built to reduce erosion and minimize stream crossings.	3	10	County of San Mateo, State Parks	33.50	33.50				67	An evaluation of trails should be conducted in order to prioritize efforts. Cost based on erosion assessment for acres (assume 25% of total watershed acres) at a rate of $14.37/acre.
PilC-CCCS-21.1.1.2	Action Step	Recreation	Eliminate horse access to creeks for watering or as fords.	3	5	San Mateo RCD, State Parks	290.00					290	State Parks has received notification by NMFS regarding horse access to Pilarcitos Lagoon. To date not action by State Parks has been taken. An equestrian bridge for lower Pilarcitos was identified as a potential restoration project by PWA (2008). Other solutions that would result in major cost savings could included rerouting equestrian trails or prohibiting access to wet water crossings. Cost based on construction of 1000 sq. ft. bridge at a rate of $289/sq. ft.
PilC-CCCS-22.1	**Objective**	**Residential /Commercial Development**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-22.1.1	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PilC-CCCS-22.1.1.1	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	100	Caltrans, City of Half Moon Bay, Coastside County Water District, County of San Mateo, POST, San Mateo RCD						0	Action is considered In-Kind
PilC-CCCS-22.1.2	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
PilC-CCCS-22.1.2.1	Action Step	Residential /Commercial Development	Avoid new development within riparian zones and the 100 year floodprone zones.	1	100	City of Half Moon Bay, County of San Mateo, FEMA							Avoiding development in areas prone to damage from flooding should result in a net savings.
PilC-CCCS-22.1.3	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to watershed hydrology										

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-22.1.3.1	Action Step	Residential /Commercial Development	New development should minimize storm-water runoff, changes in duration, or magnitude of peak flow.	2	100	Caltrans, City of Half Moon Bay, County of San Mateo, RWQCB						TBD	This is a standard business practice for larger development projects. The same standards should apply to all new projects. Costs cannot be estimated at this time.
PilC-CCCS-22.1.3.2	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	100	Caltrans, City of Half Moon Bay, County of San Mateo, RWQCB						TBD	Cost cannot be determined without identifying the number of detention basins needed.
PilC-CCCS-22.1.4	Recovery Action	Residential /Commercial Development	Prevent or minimize increased landscape disturbance										
PilC-CCCS-22.1.4.1	Action Step	Residential /Commercial Development	Improve policies, education and awareness of agencies, landowners and the public regarding salmonid protection and habitat requirements.	2	10	CDFW, Counties, NMFS, Public						0	Action is considered In-Kind
PilC-CCCS-22.1.4.2	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	100	Caltrans, City of Half Moon Bay, Coastside County Water District, County of San Mateo, San Mateo RCD, SFPUC						0	Action is considered In-Kind
PilC-CCCS-22.2	**Objective**	**Residential /Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
PilC-CCCS-22.2.1	Recovery Action	Residential /Commercial Development	Prevent or minimize increased landscape disturbance										
PilC-CCCS-22.2.1.1	Action Step	Residential /Commercial Development	Encourage counties and local municipalities to expand riparian buffer widths for new development (including redevelopment).	2	10	City of Half Moon Bay, County of San Mateo						0	Action is considered In-Kind
PilC-CCCS-22.2.1.2	Action Step	Residential /Commercial Development	Implement performance standards in Stormwater Management Plans.	2	10	RWQCB						0	Action is considered In-Kind
PilC-CCCS-22.2.1.3	Action Step	Residential /Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	2	100	City of Half Moon Bay, Coastside County Water District, Corps, County of San Mateo, POST, San Mateo RCD, State Parks						TBD	TBD, cost cannot be determined because recommendation is based on willingness of landowners to participate.
PilC-CCCS-22.2.1.4	Action Step	Residential /Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	100	City of Half Moon Bay, County of San Mateo						0	Action is considered In-Kind
PilC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance										

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Continue training County Road Maintenance staff through the FishNet 4C program.	2	100	Caltrans, City of Half Moon Bay, Coastside County Water District, County of San Mateo, Farm Bureau, NRCS, POST, RWQCB, San Mateo RCD, SFPUC, State Parks						0	Action is considered In-Kind
PilC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Work with RCD or NRCS to encourage landowners to conduct appropriate road assessments within high priority watersheds.	2	5	Caltrans, Coastside County Water District, County of San Mateo, NRCS, POST, SFPUC, State Parks	45.00					45	Cost estimate as reported in Pilarcitos Integrated Watershed Management Plan (PWA 2008). Actual costs may be higher depending on the detail and condition of the road network. Road inventories in the Salmon Creek watershed totaled $1068/mile.
PilC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
PilC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	100	Caltrans, CDFW, City of Half Moon Bay, County of San Mateo, NRCS						0	Action is considered In-Kind
PilC-CCCS-23.1.2.2	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	1	100	Caltrans, City of Half Moon Bay, County of San Mateo, NRCS, POST, San Mateo RCD, State Parks						0	Action is considered In-Kind
PilC-CCCS-23.1.2.3	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, City of Half Moon Bay, Corps, County of San Mateo, NRCS, State Parks						0	Action is considered In-Kind
PilC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent alterations to sediment transport (road condition/density, dams etc.)										
PilC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	20	Caltrans, County of San Mateo, Farm Bureau, NRCS, POST, Private Landowners, San Mateo RCD, SFPUC, State Parks						0	Action is considered In-Kind
PilC-CCCS-23.1.3.2	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	2	Caltrans, City of Half Moon Bay, County of San Mateo, POST, RWQCB, State Parks						TBD	Costs of figuring out where to place road spoils in this watershed should be minimal. This program should be in place in two years and remain in place in perpetuity.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-23.1.3.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	Caltrans, City of Half Moon Bay, Coastside County Water District, NOAA RC, NRCS, POST, RWQCB, San Mateo RCD, SFPUC, State Parks	14.00	14.00				28	Costs cannot be determined until completion of a road assessment plan. Road decommission costs for California were estimated by NMFS to cost $13,680/mile. Cost based on decommissioning 2 miles of road at a rate of $13,680/mile.
PilC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
PilC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent alterations to sediment transport (road condition/density, dams etc.)										
PilC-CCCS-23.2.1.1	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.	1	100	Caltrans, City of Half Moon Bay, County of San Mateo						0	Avoiding placing roads within floodprone zones will likely result in a long term cost savings. Action is considered In-Kind
PilC-CCCS-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
PilC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PilC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Enforce existing, and support development of new, regulations to minimize impacts on summer baseflow from water rights users.	2	10	CDFW, Coastside County Water District, NMFS, POST, SFPUC, SWRCB						0	Action is considered In-Kind
PilC-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Increase oversight on water diversions.	1	100	CDFW, Coastside County Water District, NMFS, POST, SFPUC, SWRCB						0	Action is considered In-Kind
PilC-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	1	100	SWRCB							Review Hydrology and Water Diversion Strategies for cost estimate.
PilC-CCCS-24.1.1.4	Action Step	Severe Weather Patterns	Work with CDFW, County and knowledgeable biologists to develop emergency rules that consider the lifehistory requirements of salmonids and adopt implementation agreements regarding contingency efforts during drought conditions.	2	15	City of Half Moon Bay, Coastside County Water District, County of San Mateo, RWQCB, San Mateo RCD, SFPUC, SWRCB						0	Due to the condition of the Pilarcitos and the many competing water uses, a watershed specific plan will need to be developed. Action is considered In-Kind
PilC-CCCS-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology										
PilC-CCCS-24.1.2.1	Action Step	Severe Weather Patterns	Review Water Diversion and Impoundment and Hydrology recommendations for additional strategies.										
PilC-CCCS-24.1.2.2	Action Step	Severe Weather Patterns	Evaluate watershed for infrastructure at high risk of flooding.	3	20	City of Half Moon Bay, County of San Mateo, FEMA	3.75	3.75	3.75	3.75		15	This exercise can be easily accomplish through a review of existing aerial images, documentation, and FEMA maps.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-24.2	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**										
PilC-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PilC-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Establish minimum summer releases from the Pilarcitos reservoir and Old Stone to provide adequate spawning, rearing, and migration habitat during all water years.	1	5	CDFW, Coastside County Water District, NMFS, SFPUC, SWRCB						0	Action is considered In-Kind
PilC-CCCS-24.2.1.2	Action Step	Severe Weather Patterns	Establish critical flow values for the entire Pilarcitos Watershed.	2	10	Coastside County Water District, Farm Bureau, POST, Private Landowners, Sewer Authority Mid-Coastside, SFPUC, State Parks	74.00	74.00				148	Critical flow values should include minimum bypass flows for adult and smolt migration as well as juvenile rearing. Cost based on stream flow/precipitation monitoring at a rate of $74195/project. Efforts recommend to address Hydrology could be combined and would result in significant cost savings.
PilC-CCCS-24.2.1.3	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain migration and viable rearing habitat, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	1	100	CDFW, City of Half Moon Bay, Coastside County Water District, NMFS, POST, Private Landowners, San Mateo RCD, Sewer Authority Mid-Coastside, SFPUC						TBD	TBD cost from above action to identify critical level and opportunities for reducing water consumption.
PilC-CCCS-24.2.1.4	Action Step	Severe Weather Patterns	Evaluate and assess impacts of local groundwater withdrawals in Pilarcitos Creek watershed.	2	10	City of Half Moon Bay, Coastside County Water District, SFPUC, State Parks, SWRCB						TBD	Efforts should assess and compile results of all prior investigations.
PilC-CCCS-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PilC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PilC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Promote water conservation for all landowners in the watershed.	2	10	City of Half Moon Bay, Coastside County Water District, Farm Bureau, MCRRFCD, NRCS, San Mateo RCD, SWRCB						0	Promoting water conservation practices is not expected to result in additional costs. Actual implementation costs will result in costs that cannot be determined due to the wide variety of potential solutions for water conservation.

Pilarcitos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PilC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	Promote the use of reclaimed water for agricultural or other uses.	1	15	City of Half Moon Bay, Coastside County Water District, Farm Bureau, POST, San Mateo RCD, Sewer Authority Mid-Coastside, SFPUC, Sonoma County Water Agency, State Parks						0	This strategy was ranked as a top priority in the Pilarcitos Integrated Watershed Management Plan (PWA 2008). Action is considered In-Kind
PilC-CCCS-25.1.1.3	Action Step	Water Diversion /Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	20	CDFW, MCRRFCD, Mendocino County, Private Landowners, RCD, RWQCB, Sonoma County, Sonoma County Water Agency						TBD	See Hydrology section for cost estimate. Promoting these type of projects will require a sustained effort to target willing landowners in critical stream reaches.
PilC-CCCS-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
PilC-CCCS-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
PilC-CCCS-25.2.1.1	Action Step	Water Diversion /Impoundment	Encourage the SWRCB to adjudicate watersheds with CCC steelhead to resolve over-allocation of water resources and provide adequate funding to water masters to enforce allocations.	2	10	NMFS, SWRCB						0	Action is considered In-Kind
PilC-CCCS-25.2.1.2	Action Step	Water Diversion /Impoundment	Petition SWRCB to declare the watershed fully appropriated.	3	15	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
PilC-CCCS-25.2.1.3	Action Step	Water Diversion /Impoundment	Request SWRCB to conduct interagency consultation with CDFW, and seek technical assistance from NMFS on the issuance of water rights permits.	3	15	NMFS, RWQCB						0	Additional regulatory authorities may be needed to fully implement this action, and associated costs cannot be determined. However technical assistance may be provided, and are In-Kind
PilC-CCCS-25.2.1.4	Action Step	Water Diversion /Impoundment	Work within existing federal, state and local regulations to minimize harm to steelhead from water diversion activities.	3	25	Federal, Local, State						0	Action is considered In-Kind
PilC-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.	3	10	CDFW, NMFS, RWQCB						0	Action is considered In-Kind

San Gregorio Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 1,700 adults
- Current Intrinsic Potential: 46.6 IP-km

Steelhead Abundance and Distribution

San Gregorio Creek is the second largest watershed in coastal San Mateo County, draining an area of approximately 33,390 acres in five sub-basins comprising approximately 46 miles of stream channel. San Gregorio Creek is formed by the confluence of La Honda and Alpine Creeks and flows west through steep canyons of redwood, Douglas-fir, and tan oak forests before entering the San Gregorio Creek lagoon and the Pacific Ocean. Other important tributaries include El Corte Madera, Bogess, and Harrington Creeks (Becker *et al*. 2010).

When surveyed in 1870, San Gregorio Creek apparently produced sufficient steelhead and coho salmon to support a commercial fishery within the watershed (Skinner 1962). San Gregorio Creek was one of four "A-1" streams noted in San Mateo County in a 1912 memo, which also noted the stream was stocked (Smith 1912, in Becker *et al*. 2010). A California Department of Fish and Game/Wildlife (CDFG/CDFW) field note from 1962 relays the warden's estimate of the maximum steelhead run at about 1,000 individuals. The 1961-1962 run was estimated to be about 300 individuals (CDFG 1962b, in Becker *et al*. 2010); estimation methods are not provided. In 1970, 216 adults returning to the ocean were captured at an out migrant trap (Coots 1971). In 1975, CDFG staff stated that "the San Gregorio River system is one of the more important salmonid spawning and nursery resources along the coast of central California" (CDFG 1975b in Becker *et al*. 2010).

Recent surveys within San Gregorio Creek generally documented presence of juvenile rainbow trout/steelhead within accessible habitat and relatively high densities for some locations. During August-September 1985, CDFG surveyed San Gregorio Creek in nearly its entirety, from the headwaters at La Honda and Alpine Creeks to the mouth. The size of the juvenile steelhead/rainbow trout population ranged from moderate to abundant within the survey area. Surveys conducted by CDFG in Alpine Creek in 1963 and 1973 yielded visual estimates of juvenile steelhead densities of about 1,000 fish/30 m and 10-20 fish/pool, respectively (Titus *et al*. 2010). CDFG conducted surveys in La Honda Creek in 1964 and 1973. In 1964, juvenile steelhead and/or rainbow trout occurred at a visually estimated density of 50 fish/30 m in the

lowermost 4.8 km of stream. In 1973, juvenile steelhead occurred in the lowermost 9 km of the stream at visually estimated densities of 15-20 trout/pool and 20-50 trout/pool in the middle and lower reaches, respectively (Titus *et al*. 2010). In 1978, in La Honda Creek above the confluence with Woodruff Creek, a density of 100 fish/30 m was visually estimated (Titus *et al*. 2010).

Current adult population size estimates for San Gregorio Creek are not available. Steelhead are currently distributed within the mainstem San Gregorio Creek, within all significant tributaries, and in the lagoon (SGCWMP). The San Gregorio system is one of the principal steelhead watersheds in San Mateo County (Titus *et al*. 2010).

History of Land Use

Coastanoan Indians were the first inhabitants of the watershed, subsisting by hunting, fishing and gathering native plants. Spanish missionaries arrived in the San Francisco Bay area in 1776, establishing a series of local missions and settlements (Stillwater Sciences et al., 2010). In 1821, Mexican rule was established and large "ranchos" were delineated. The establishment of large land holdings altered the emphasis of the area's agricultural economy from small subsistence plots to large cattle ranches. The ranchos were under Mexican rule from 1822 to 1846, and they were used as dairies and for farming in addition to cattle ranching. Rancho San Gregorio (18,000 acres) encompassed present-day San Gregorio and La Honda.

During the Gold Rush in the mid-19th century, new settlers in the watershed incrementally bought or squatted on portions of the ranchos (Stillwater Sciences et al., 2010). The increasing development in California in general, and the Bay Area specifically, required building materials, and prompted timber harvesting in the Santa Cruz Mountains. Numerous logging camps were established in the watershed. Meanwhile, an influx of farmers began developing the flat lands in the lowest portions of the watershed into larger agricultural operations. With the influx of people and industry came an expanding road network.

As logging diminished, the area began to be used for recreation and residential use (Stillwater Sciences et al., 2010). Several lodges were built in the 1920s to accommodate Bay Area visitors, and plots were subdivided for summer cabins. Many early vacation cabins are now, or have been replaced with, year-round residences. Oil drilling also occurred in the La Honda Creek oil field beginning in the late 19th century, and continues on a small scale (Stillwater Sciences et al., 2010).

Current Resources and Land Management

Overall, land use in the watershed has evolved from subsistence hunting and gathering prior to the 1800s to ranching (both beef and dairy) and agricultural production. Current land use is a mix of agriculture, urban/residential uses, and forestland and rangeland that overlaps with designated open space. The watershed was adjudicated in 1993 (Stillwater Sciences et al., 2010). According to the 2010 census, the population of the watershed is 1,952.

The entire watershed lies in unincorporated San Mateo County and is subject to the County's General Plan. A portion of the watershed also lies in the Coastal Zone and is therefore regulated by the County's Local Coastal Program. Most of the land in the watershed is zoned Resource Management (RM), Timberland Preserve Zone, Planned Agricultural District, Community Open Space Conservation District, with some Residential (Stillwater Sciences et al., 2010).

Rangeland zoned as RM is the dominant land use in the watershed. Timber harvesting primarily occurs in the headwaters of the watershed. Agriculture also occurs in the watershed, with crops including apples, cauliflower, brussel sprouts, wine grapes, and artichokes. Urban or built-up land is focused around the communities of San Gregorio and La Honda. A significant portion of the watershed is used as parks and open space preserves. Mid-peninsula Regional Open Space District owns and manages 33 percent of the watershed and is the largest landowner (Stillwater Sciences et al., 2010).

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated "Poor" through the CAP process: estuary, habitat complexity, sediment transport, hydrology, and water quality. Recovery strategies will focus on improving these Poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

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

Population and Habitat Conditions

Estuary: Quality & Extent

Estuaries/lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats even when conditions are marginally suitable (Bond *et al*., 2008, Smith 1990, Atkinson 2010). Well-mixed (i.e., not salinity stratified) lagoons, or lagoons comprised of mostly freshwater, can maintain a relatively cool, well oxygenated, and food rich environment that provides high quality habitat for juvenile steelhead (Hayes *et al*. 2008, Smith 1990). Atkinson (2010) found an abundance of steelhead rearing in the San Gregorio lagoon in both 2005 and 2006. Juvenile steelhead were substantially larger than those in two stream reaches in the upper watershed despite repeated artificial breaching of the sandbar in both years which prevented complete destratification in the lagoon. Atkinson (2010) found that sizes of age 0+ and yearlings in the lagoon were more related to time spent in the lagoon than to their age. The benefits of the lagoon (e.g., increased growth and probability of ocean survival) are significantly compromised when the lagoon prematurely opens due to intentional unauthorized breaching of the sandbar during the summer and fall. Besides causing poor water quality conditions for steelhead rearing during the summer and fall, fish kills have been associated with artificial breaching events in Pescadero Creek and San Gregorio Creek lagoons (Atkinson 2010). In spring of most years, there is little residual depth in the lagoon and therefore there is little opportunity for smolts from the upper watershed to adjust to saltwater or to feed and grow prior to entering the ocean. The addition of structure (e.g., wood piles), or the restoration of historic meanders, would induce scour and provide more residual depth in the lagoon during periods when the sandbar is open.

Sediment Transport: Road Density

Excessive sediment transport rates in the San Gregorio watershed compromise spawning and rearing habitat. Pool filling appears to result from upslope erosion and has been noted to reduce available habitat throughout the San Gregorio Creek watershed since the 1970s (Titus *et al.* 2010). Threats that contribute to the altered sediment transport include agriculture, recreational trails, grazing, urbanization, roads, and logging.

Water Quality: Temperature and Water Quality: Turbidity or Toxicity

The San Gregorio Creek watershed is currently listed as impaired for bacteria and sediment under Section 303(d) of the Clean Water Act (SFBRWQCB 2006). Water temperature was considered suboptimal; temperatures thresholds for juvenile coho salmon, which are lower than those for steelhead, were exceeded at some of the sampling locations according to information presented in the San Gregorio Creek Watershed Management Plan (Stillwater Sciences et al., 2010). NMFS determined setting temperature thresholds based on the more narrow range of coho salmon thermal requirements was appropriate for watersheds with co-occurring populations of CCC coho salmon and CCC steelhead.

Water quality sampling data (Stillwater Sciences et al., 2010) indicated elevated turbidity levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency, and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary lifestage affected by high turbidity levels.

Habitat Complexity: Large Wood & Shelter

According to Stillwater Sciences et al., (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. Therefore LWD is an even more critical habitat element than in more northern streams to form pools or areas of refuge from high flows. CDFG stream surveys indicate a lack of LWD within the San Gregorio Creek watershed (CDFG 1996a, 1996b, 1996c, 1996d, 1996e, 1996f, 1997a, 1997b) where all but one stream were rated as "Poor". Low LWD abundance within San Gregorio Creek is likely the result of past logging practices that removed trees from riparian areas and stream clearance efforts. The lack of LWD likely is the major contributor to the lower shelter values estimated in the watershed (an average rating of 0 out of a possible total shelter rating of 300). Reduced large wood and shelter adversely affect the summer, winter, and smolt lifestages in San Gregorio Creek.

Hydrology: Baseflow & Passage Flows

Low instream flow in San Gregorio Creek has been identified as a factor limiting age 0+ and age 1+ steelhead abundance, and upstream migration of adult steelhead and coho salmon during dry years. CDFW stream surveys, other local literature, and a field survey by Stillwater Sciences (Stillwater Sciences et al., 2010) noted dry stream reaches in the late summer and fall in some years. Dry reaches restrict availability and access to riffle and deep-pool rearing habitats. By summer, particularly in dry years, flows in many portions of San Gregorio Creek are extremely low, decreasing access and contributing to habitat loss during the rearing period. When low flows restrict the amount of area for rearing, intraspecific competition for food and space is increased in the remaining habitat. Low flows can also decrease invertebrate production in riffles (Harvey *et al.* 2006). Therefore growth rates, in particular, could be reduced by low flow summer conditions (i.e., reduced food supply, increased density in pools), especially when water temperature increases as a result of decreased flow.

Threats

The following discussion focuses on those threats that were rated as High or Very High. Recovery strategies will likely focus on ameliorating High rated threats; however, some

strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in San Gregorio Creek CAP Results.

Fire and Fuel Management

Some areas in the San Gregorio watershed have a High fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures, which are already above optimal condition along the mainstem, would likely result.

Residential and Commercial Development

The 2010 census estimated the population within San Gregorio Creek at 1.952 individuals; six percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009), with the majority of the development located in close proximity to the various watercourses. Although the population in the watershed is relatively low as compared to many other watersheds in the DPS, the proximity of residences to stream channels places riparian areas and stream channels at greater risk for future alteration. Many residences are prone to flooding, and efforts to minimize the impacts of flooding will likely include removing instream habitat features, such as wood debris (a practice that has occurred in the past). Residences located adjacent to stream channels are often at increased risk of bank erosion, and efforts to protect existing infrastructure will likely include stabilization efforts that could further degrade salmonid habitat.

Roads

Road densities are high throughout the watershed, and are estimated at 3.0 miles of road per square mile of watershed area, and at 3.2 miles per square mile of riparian area. Many of these roads are poorly situated and constructed, and improperly maintained. Even through chronic erosion decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (ESA 2004). Legacy roads from past logging activity have been adopted as year-round roads and recreational trails, and continue to impact the San Gregorio watershed.

On many forest and ranch roads, located on both public and private lands, periodic maintenance falls short of addressing chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossings

can continue and even exacerbate the rate of fine sediment delivery to the stream channel. Additionally, paved and unpaved roads parallel many of the waterways within San Gregorio Creek and may impinge channel migration.

Recreational Areas and Activities

Recreational areas were rated as a High threat for summer rearing juveniles due to periodic unauthorized breaching of the San Gregorio lagoon sandbar and extensive trail networks in the upper portion of the watershed. Atkinson (2010) documented numerous illegal breachings of the sandbar, which is located on property owned and managed by California State Parks. These breaches are usually initiated by visitors to San Gregorio State Beach and are reoccurring events (California Trout 1971; in Stillwater Sciences et al., 2010; Smith 1990). Additionally, many of the former logging roads in the upper portion of the watershed are now used as recreational trails by mountain bikers. These trails are often very steep and contribute substantial fine sediment to San Gregorio Creek due to inadequate maintenance practices and poor trail locations (Ambrose, pers. obs. 2002).

Severe Weather Patterns

Extreme flood events could result in major erosion within upslope locations. A large proportion of the watershed is comprised of erodible geology that would likely impact spawning and rearing habitats when sediment enters the stream channel. Changes and improvements in land use practices will likely lower sediment yield rates following future flooding events. However, much of the watershed is considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions.

Due to the heavy overdraft of water resources from San Gregorio Creek, the impact of a severe drought could be devastating to all lifestages of steelhead in the watershed. Numerous diversions are located throughout the watershed in every major tributary. Although a water master is appointed, the required minimum bypass flows set by the Courts were not based on salmonid requirements. Severe drought, particularly if occurring over a period of two or more years, would likely adversely impact steelhead habitat throughout the watershed and reduce the overall carrying capacity of available habitat.

Water Diversion and Impoundment

Aquatic conditions in San Gregorio Creek are adversely affected by water diversions; therefore, the watershed was designated as a Fully Appropriated Stream by the California State Water Resources Control Board (SWRCB). (See the following discussion in the next page.) Water management operations adversely impact almost all steelhead lifestages, particularly during drought conditions. Additionally, water diversions reduce freshwater inflow to the estuary and

extend the duration necessary for conversion to a freshwater lagoon during the summer. Water diversions are distributed throughout the watershed's many tributaries as well as the mainstem of San Gregorio Creek. These diversions, coupled with poor instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. Notable flow fluctuations are occasionally measured at the USGS San Gregorio stream gauge during the summer and fall. For example, flows will drop from approximately one cfs to near zero over a period of a few hours and then return to one cfs several hours later. The cause of these fluctuations is unknown, and although specific effects on instream conditions have not been determined, they are likely detrimental to fish and their habitat. The magnitude of this effect is not currently known. However, it is known that during below-normal water years, the available water supply is insufficient to meet all the water rights allocated in the watershed and also provide instream flows necessary for aquatic species.

The watershed was adjudicated in 1993 (Superior Court of San Mateo, Decree #355792), and the rights of all users to divert water within the watershed were established through the court decree. For each water right, the adjudication defines the type of water usage, the priority for delivery, the volume of annual allowable diversions, the time period diversions are permitted, and the associated point of diversion. In addition, under the adjudication, all new water diversions (or activation of unexercised riparian rights) in the watershed are subject to the requirements for maintenance of minimum instream flows.

The number of individual landowners in the watershed who maintain groundwater wells for residential and irrigation water supply is not known. The total number of wells in the watershed between 2006 and 2008, as contained within San Mateo County Environmental Health Division (EHD) records, was estimated at 311 (Table 2-6). The majority of these wells (79 percent) are situated in the eastern half of the watershed, which primarily acts as an area of groundwater recharge to the basin aquifer in the valley. These groundwater wells in combination with on-stream diversions likely contribute to significant degradation of habitat for all lifestages in all but very wet water years.

Limiting Conditions, Lifestages, and Habitats

Threat and condition analysis within the CAP workbook indicates all lifestages are impaired in the San Gregorio watershed. Water quantity and quality are inadequate for properly functioning estuarine conditions, and are the result of direct water diversions in the estuary during the summer and late fall.

General Recovery Strategy

Restore San Gregorio Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoration of limiting factors in the estuary will benefit steelhead production in the entire watershed and the steelhead population in the Santa Cruz Mountains diversity stratum. Restoration should address breaching and issues impairing water quality, water quantity, habitat availability, and habitat suitability. Efforts should focus on the ultimate causes of impairment as well as the proximate issues that limit current habitat suitability. A comprehensive watershed-wide program to address sediment input, water quantity, and water quality should be initiated in addition to implementation of immediate measures that address and remediate unauthorized sandbar breaching and restore the historical tidal prism. The San Gregorio estuary, unlike many degraded California estuaries, can be restored to its biological potential through a focused and comprehensive effort that increases freshwater inflow, re-establishes connectivity with the marsh area east of the Highway 1 Bridge, and implements lagoon sandbar monitoring and enforcement to prevent artificial breaching. Actions that will induce scour, such as restoring the historic alignment of the creek east of Highway 1 or the addition of large wood will encourage scour and increase the amount of deeper habitats for spring feeding and saltwater adjustment for smolts while the sandbar is open.

Minimize Diversions and Diversion Effects

Direct stream diversions and possibly alluvial groundwater pumping in the eastern portion of the watershed adversely impact almost all steelhead lifestages, and were determined as the most significant threat to steelhead in the watershed. Low instream flows have been identified to limit the abundance of age 0+ and age 1+ steelhead, and the migration of adult steelhead during dry years in San Gregorio Creek. Water diversions reduce the quantity of water in the wetted stream channel, increasing diurnal temperature fluctuations and reducing available rearing habitat. Additionally, the diversions likely impact water circulation and thermal regimes when the estuary bars over, reducing available rearing habitat and placing rearing salmonids at greater risk when the sandbar prematurely breaches.

The San Gregorio watershed is adjudicated, and a minimum bypass requirement of 2 cfs was established for new diversions. However, this requirement does not apply to existing water diversions, and flows are often less than 2 cfs in summer and fall (Stillwater Sciences et al., 2010). During the adjudication process in the 1980's, the 2 cfs bypass requirement for existing diversions was removed, despite protests by the Department of Parks and Recreation. In addition, the CDFG Recovery Plan for coho salmon (CDFG 2004) states that the prescribed

bypass flows are too low to ensure viable coho salmon populations. NMFS believes that the concerns for coho salmon are also applicable to steelhead, and that a minimum bypass flow of 5 cfs should or could be applied to all water diversions, including existing and new wells, riparian pumping, and stream side wells. Flows that are appropriate and protective for coho salmon are also appropriate and protective for steelhead due to (1) many similar habitat requirements during the juvenile lifestage, (2) these species often co-occurring together, and (3) increased bypass is anticipated to result in greater habitat availability leading to increased carrying capacity. To reduce the amount of water diverted from the streams and pumped from the alluvial groundwater basin and potentially maintain summer and fall instream flows, domestic, agricultural, and recreational water conservation strategies should be implemented (Stillwater Sciences et al., 2010). Efforts to address the adverse impacts of water diversions could include increased oversight by the SWRCB (and County of San Mateo for groundwater wells) for permitted diversions, and enforcement of applicable laws for unpermitted diversions. Additional practices could include developing off-channel storage facilities to divert water during the winter high flow period in exchange for leaving water instream during the summer low-flow period. Efforts to coordinate diversion timing and water sharing through conjunctive use agreements should also be developed to minimize impacts.

Improve Instream Habitat Quality and Quantity

Returning riparian corridors to properly functioning condition alone is unlikely to solve the poor instream habitat conditions prevalent throughout much of the watershed. While improved riparian function will increase wood recruitment into streams, further restoration will be required to restore degraded conditions. Recovery actions should focus on improving spawning habitat, installation of standard log/boulder habitat structures for rearing and overwintering habitat, and development of off-channel habitats. In stream reaches with little immediate downstream infrastructure, properly-sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation.

CDFW stream surveys, local and regional literature, and a field survey by Stillwater Sciences identified a lack of available winter and summer habitat as a factor limiting the steelhead population (and a likely factor limiting coho salmon recovery) in the San Gregorio Creek watershed (Stillwater Sciences et al., 2010). Winter habitat has been degraded for both species in part from a lack of LWD, which provides important slow-water refuge areas during high flow events (Stillwater Sciences et al., 2010). Steelhead summer habitat has also been degraded by the lack of LWD, which helps to form pools where steelhead can over-summer, and provides cover and protection from predators.

Winter habitat LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should be implemented and designed to provide cover, and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated to threaten adjacent infrastructure.

Investigate and Address Sediment Sources

The San Gregorio Creek Watershed Information Center includes six detailed and relatively recent inventories of bank erosion, landslide, and road-related fine sediment supply areas located primarily on Mid-peninsula Open Regional Open Space District and San Mateo County properties. In addition, the San Mateo County RCD is conducting additional assessments and geospatial analysis of roads in the watershed as part of its Rural Roads Program. Implementing the high priority recommendations for treatment in these inventories is a logical and cost-effective way to remediate known sources of fine sediment.

A shallow landslide model predicted about 4.4% of the watershed as chronic or high instability in the headwater regions of the El Corte de Madera, La Honda, and Mindego Creek sub-basins. Repairing and decommissioning roads in areas predicted as chronically or highly unstable could reduce the likelihood of sediment input from these areas. Additionally, Stillwater Sciences et al., (2010) reported that while the geology of forest lands were predicted to be more unstable than the geology in areas managed as rangelands, the rangeland areas had more than double the density of debris flows than forest lands. These results suggest land use influences debris flow occurrence and potential sediment delivery, suggesting that land use practices should be carefully evaluated and its potential to contribute to sediment delivery addressed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding.

Floodplain

A lack of available winter refuge habitat, due in part to lack of access to inundated floodplain or off-channel habitats, has been identified as a limiting factor for coho salmon in the watershed according to Stillwater Sciences et al. (2010). This limiting factor for coho salmon is likely also a limiting factor for steelhead in the watershed, but to a lesser degree. According to Stillwater Sciences et al. (2010), the lower mainstem San Gregorio Creek historically may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing

refuge habitat for salmonids during high flows. Mainstem channel and low gradient tributary reaches should be assessed to target opportunities to restore floodplain connectivity.

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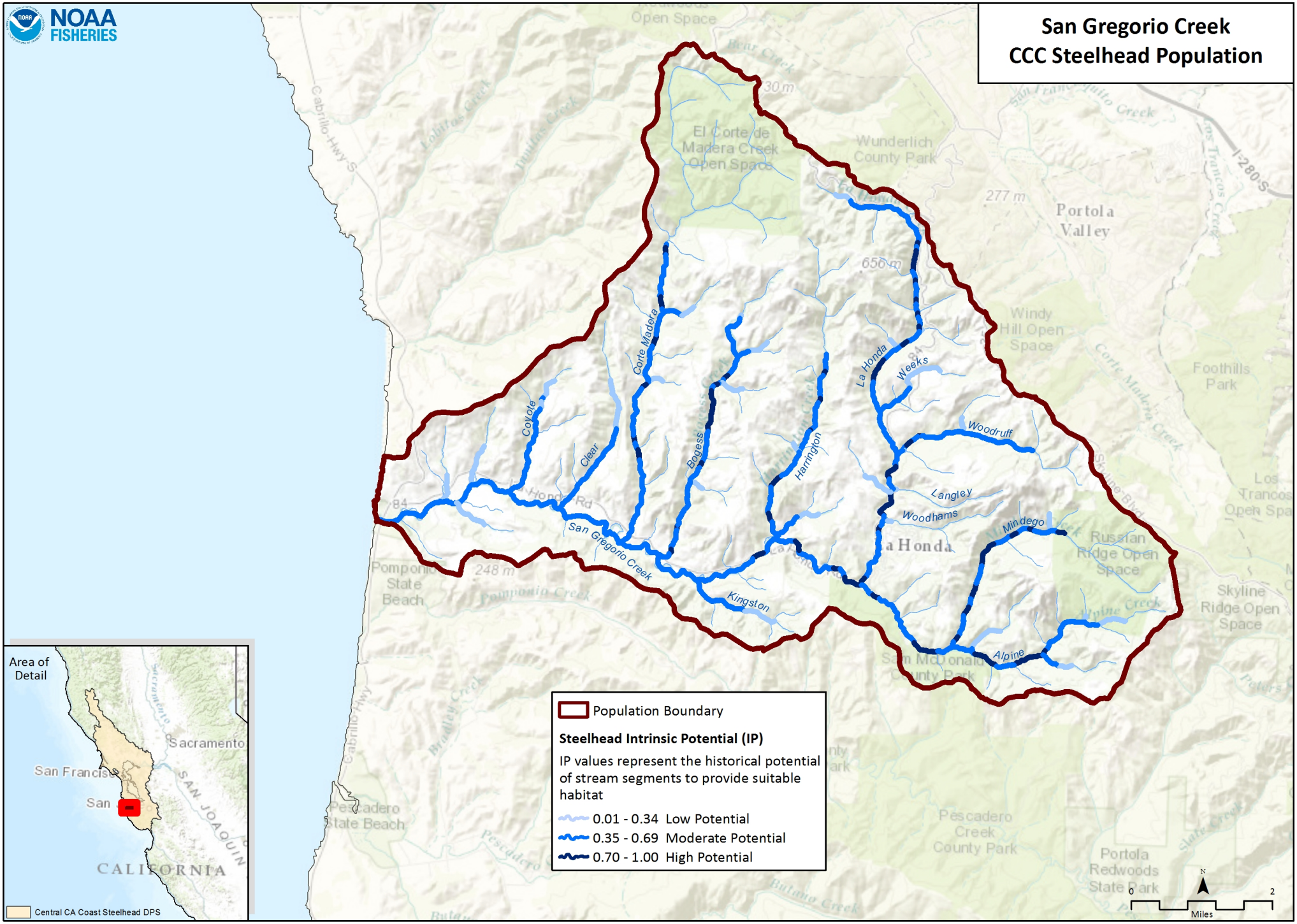
San Gregorio Creek
CCC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Sacramento
San Francisco
San
CALIFORNIA
Central CA Coast Steelhead DPS
Corte Madera
Coyote
Clear
Bogess
Harrington
La Honda
Weeks
Woodruff
Langley
Woodhams
Mindego
Alpine
Kingston
San Gregorio Creek
Portola Valley
Wunderlich County Park
El Corte de Madera Creek Open Space
Windy Hill Open Space
Foothills Park
Russian Ridge Open Space
Skyline Ridge Open Space
Pomponio State Beach
Pescadero State Beach
Pescadero Creek County Park
Portola Redwoods State Park
Miles

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	56% streams/ 72% 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 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	77.5 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		
			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	?80% Density rating "D" across IP-km	Good

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km 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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		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 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (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)	22% streams/ 23% 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	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	11% streams/ 27% 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)	56% streams/ 72% 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 >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	2.2 Diversions/10 IP-km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	77.5 of IP-km	Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	22% streams/ 23% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	<50% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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)	56% streams/ 72% IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	77.5 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		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	22% streams/ 23% IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	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	2.2 Diversions/10 IP-km	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.28% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.71% 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	6% 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	3.0 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	3.2 Miles/Square Mile	Poor

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

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-1.1.1	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
SGC-CCCS-1.1.1.1	Action Step	Estuary	Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.	3	5	CA Coastal Commission, California Coastal Conservancy, CDFW, IWRP, San Mateo RCD, State Parks	123.00					123	Improving quantity of structures should be targeted at providing improved residual depth during low tide in spring for smolt transition and feeding. Cost to treat 3 acres (assume 1 project/acre in 10% of total estuarine habitat) at a rate of $41,000/acre.
SGC-CCCS-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
SGC-CCCS-1.1.2.1	Action Step	Estuary	Encourage State Parks to develop alternative access points to San Gregorio Beach.	2	5	NMFS, State Parks						0	In some years, beach goers cannot access the beach without entering the lagoon. This may encourage illegal breaching. An alternative access point may minimize motivation to breach the sandbar. Action is considered In-Kind
SGC-CCCS-1.1.2.2	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff, and law enforcement to ensure the sandbar is not breached.	2	100	CDFW Law Enforcement, NMFS OLE, Public, State Parks						0	The majority of this responsibility should belong to State Park who manage San Gregorio beach and the associated parking lot. State Parks staff working at San Gregorio beach should be encouraged to monitor the lagoon throughout the summer and fall sandbar closure period on a regular basis. Other methods should also be evaluated such as installation of cameras that provide real time oversight to ensure the sandbar is closely monitored during periods when patrols are not occurring. Action is considered In-Kind
SGC-CCCS-1.1.2.3	Action Step	Estuary	Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the lagoon.	2	100	CDFW Law Enforcement, NMFS OLE, State Parks						TBD	Financial rewards may act as a deterrent to those involved in unauthorized breaching of the lagoon. Breaching is believed to result in significant adverse impacts to salmonids and tidewater goby rearing in the lagoon.
SGC-CCCS-1.1.2.4	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	California Coastal Conservancy, State Parks	1.50	1.50				3	Signs should convey messages in multiple languages and cite relevant regulations that prohibit breaching activities. Signs should be placed in multiple locations across the sandbar and not just in a kiosk. Signs should be placed on the sandbar within one day of closure and remain in place throughout the critical summer and fall periods. Signs should not be removed until the lagoon has breached on its own and will likely remain open for the duration of the winter period. Cost for signs vary widely depending on content and materials. Assume $1,000/sign for a minimum of 3 signs.
SGC-CCCS-1.1.2.5	Action Step	Estuary	Evaluate installation of a flume to control water surface elevation in the San Gregorio Lagoon during summer and fall.	3	10	CA Coastal Commission, California Coastal Conservancy, CDFW, NMFS, State Parks	0.50	0.50				1	Installation of a flume should only occur only if other higher priority actions are unsuccessful at addressing and correcting unauthorized breaches of the San Gregorio Lagoon sandbar. Installation of a flume should involve a complete management plan (similar to that used by the City of Capitola for the Soquel Creek lagoon) which includes building up of the sandbar during the late Spring and an active monitoring and maintenance effort. This action is given a lower priority because it active management should be considered as a last resort for restoring lagoon function. However, if unauthorized breaching continues over the next ten years, more active management will be necessary. Cost estimate does not include yearly operational expenses.
SGC-CCCS-1.1.3	Recovery Action	Estuary	Reduce toxicity and pollutants										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-1.1.3.1	Action Step	Estuary	Work with SWRCB and water master to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	1	100	CDFW, City of San Mateo, NMFS, SWRCB						0	A water master has been appointed to San Gregorio watershed pursuant to the adjudication. The water master should closely monitor all water diversions to ensure they are in compliance with the decree. The 2cfs bypass required by the decree may not be adequate for salmonids and should not be considered the maximum quantity of water available. Action is considered In-Kind
SGC-CCCS-1.1.3.2	Action Step	Estuary	Work with the SWRCB to identify, and bring into compliance, all unauthorized water diversions in the watershed.	1	100	NMFS, SWRCB						0	Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in the SG lagoon by improving water quality. Action is considered In-Kind
SGC-CCCS-1.1.3.3	Action Step	Estuary	Remove or modify structures impairing or reducing the historical feeding and salt water transition habit where feasible and where benefits to rearing steelhead and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism with modification of culvert identified in NHI (2010) upstream of the Highway 1 Bridge.	3	10	CA Coastal Commission, California Coastal Conservancy, CDFW, NMFS, San Mateo RCD, State Parks, USACE, USFWS	25.00	25.00				50	Questions remain regarding the benefits of the action to improving conditions to the now-dewatered marsh as identified by NHI (2010) and Smith (1987). Additional benefits may be accrued for tidewater goby and USFWS should be closely consulted. Benefits to steelhead may include additional winter high water refugia and additional sources of food production for salmonids rearing in the lagoon.
SGC-CCCS-1.1.3.4	Action Step	Estuary	Review Water Diversion, Sediment, Roads and Railroads for additional recommendations.										
SGC-CCCS-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
SGC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Delineate and protect reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	California Coastal Conservancy, CDFW, San Mateo County						TBD	Significant work has occurred in recent years in San Gregorio Creek and total costs could be reduced by leveraging existing information. Cost for wetland monitoring estimated at $243,170/project.
SGC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	100	California Coastal Conservancy, CDFW, IWRP, NMFS, Private Landowners						TBD	Costs cannot be determined at this time. Implementation will depend on landowner participation.
SGC-CCCS-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	100	California Coastal Conservancy, CDFW, IWRP, NMFS, NOAA RC, San Mateo County, San Mateo RCD, USACE						TBD	Costs will vary depending on restoration action and total number of projects implemented.
SGC-CCCS-2.1.1.4	Action Step	Floodplain Connectivity	Encourage establishment of conservation easements on floodplain habitat in key stream reaches.	2	100	FEMA, MROSD, POST, Private Landowners, San Mateo County						TBD	A lack of available winter refuge habitat, due in part to lack of access to inundated floodplain or off-channel habitats, has been identified as a limiting factor for steelhead in the watershed according to Stillwater Sciences et al. (2010). According to Stillwater Sciences et al. (2010), the lower mainstem San Gregorio Creek historically may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. Mainstem channel and low gradient tributary reaches should be assessed to target opportunities to restore floodplain connectivity. Cost are dependent upon market value and landowner participation.

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-2.1.1.5	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	2	5	CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County	142.00					142	Cost based on decommissioning 10 miles of riparian road network (assume 25% of riparian roads) at a rate of $14,131/mile.
SGC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
SGC-CCCS-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFW, Farm Bureau, IWRP, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, San Mateo County, San Mateo RCD, SWRCB, Trout Unlimited						0	Promoting these type of projects will require a sustained effort to target willing landowners in critical stream reaches. Incentive programs could result in rapid acceptance of these types of water conservation programs. This recommendation (which will include transfer or modification of water rights in some circumstances) should be incorporated into all future regulatory reviews of water rights applications and streambed alteration agreements in the San Gregorio watershed. Infrastructure will likely consist of off stream storage facilities that are used to store winter flows. These devices in over allocated watersheds, must be carefully evaluated before installation. Due to the significant amount of over allocation in the watershed, the impact of off channel storage must be evaluated against potential impacts to channel forming flow events and migration requirements of adult salmonids. Action is considered In-Kind
SGC-CCCS-3.1.1.2	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore steelhead habitat.	2	10	CDFW, Farm Bureau, IWRP, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, San Mateo County, San Mateo RCD, SWRCB, Trout Unlimited						TBD	Highlighting these issues will likely require the development of MOAs between water users. Conjunctive management of water resources, utilizing surface water and groundwater area could meet the current winter demand of the local diverters. The benefits of conjunctive use include providing a reliable supplemental supply, replenishment of depleted groundwater basins, and improvements to fisheries habitat. Cost will be dependent upon participation of stakeholders.
SGC-CCCS-3.1.1.3	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	3	30	Farm Bureau, IWRP, NRCS, San Mateo RCD, Trout Unlimited						0	Action is considered In-Kind
SGC-CCCS-3.1.1.4	Action Step	Hydrology	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	100	County of San Mateo, Farm Bureau, Mid Peninsula Open Space District, MROSD, NOAA RC, NRCS, POST, Private Landowners, San Mateo RCD, SGERC, USACE, USEPA, USFWS						0	Action is considered In-Kind

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-3.1.1.5	Action Step	Hydrology	Continue to fund the maintenance and operation of the San Gregorio gauge.	2	10	SWRCB, USACE, USGS	53.50	53.50				107	Cost based on annual maintenance of stream flow gauge at an annual rate of $10,564 for 10 years.
SGC-CCCS-3.1.2	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
SGC-CCCS-3.1.2.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	10	CDFW, Farm Bureau, IWRP, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, San Mateo County, SWRCB						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.
SGC-CCCS-3.1.2.2	Action Step	Hydrology	Continue to fund the maintenance and operation of the San Gregorio gauge.	1	20	SWRCB, USACE, USGS						TBD	Cost accounted for in previous action step.
SGC-CCCS-3.1.2.3	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead. Focus initial efforts in the middle reaches and lower reaches of San Gregorio Creek.	2	10	CDFW, IWRP, Private Landowners, San Mateo County, SWRCB, Trout Unlimited	37.50	37.50				75	Program can likely leverage off other assessment efforts in the San Gregorio watershed. Low instream flow in San Gregorio Creek has been identified as a factor limiting age 0+ and age 1+ steelhead abundance (and coho when present), and upstream migration of adult steelhead and coho salmon during dry years. This is not a desired condition for fish. When low flows restrict the amount of area for rearing, competition for food and space is increased in the remaining habitat. Low flows can also decrease invertebrate production in riffles (Harvey et al., 2006). Therefore growth rates, in particular, could be reduced by low flow summer conditions (i.e., reduced food supply, increased density in pools), especially if water temperatures are increased as a result of decreased flows. Significant monitoring efforts are currently occurring in the San Gregorio watershed. Data from this monitoring effort should be evaluated and incorporated into the stream flow evaluation program as a means to reduce overall costs. However, due to the large amount of water diverted and the poor condition of the fishery it is likely an IFIM study will be needed that focuses on necessary instream flows in multiple streams and stream reaches in San Gregorio. Particular focus of this effort should be directed at stream reaches with high IP values and significant diversions. San Gregorio is most heavily over allocated streams in the San Cruz Mountains. Evaluation should also account for freshwater input into the lagoon. Cost based on stream flow model at a cost of $74,195/project.
SGC-CCCS-3.1.2.4	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFW, NMFS, NMFS OLE, Public, SWRCB, Trout Unlimited						0	Action is considered In-Kind
SGC-CCCS-3.1.2.5	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters.	1	100	CDFW, NMFS, Private Landowners, Public, SWRCB						0	Action is considered In-Kind
SGC-CCCS-3.1.2.6	Action Step	Hydrology	Review recommendation under Water Diversions and Impoundments for additional strategies.										
SGC-CCCS-3.1.3	Recovery Action	Hydrology	Minimize redd scour										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-3.1.3.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5		774					774	Redd scour is likely a limiting factor in some reaches of San Gregorio Creek, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of egg and alevin mortality. Cost based on $119,080/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $182,250 for treating 6.5 miles of high IP. Co-related to habitat complexity.
SGC-CCCS-3.2	Objective	Hydrology	Address the inadequacy of existing regulatory mechanisms										
SGC-CCCS-3.2.1	Recovery Action	Hydrology	Improve flow conditions										
SGC-CCCS-3.2.1.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	1	100	California Coastal Conservancy, CDFW, County of San Mateo, Farm Bureau, NOAA RC, NRCS, POST, Private Landowners, SWRCB, USFWS						TBD	The price at which water is sold on environmental water markets is determined by negotiations between landowners and purchasing entities. The aggregate fiscal cost of water acquisition will depend on the quantity of water acquired and whether water rights will be permanently transferred or purchased for single periods.
SGC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
SGC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County staff on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	50	CDFW, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						0	Program should initially be directed at landowners along important stream reaches where large wood removal has been identified as an ongoing concern by the resource agencies and the County of San Mateo. Action is considered In-Kind
SGC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	10	CDFW, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE							This is a high priority for the San Gregorio watershed. Overall costs may be reduced by assessing and leveraging past surveys and ongoing assessment in the watershed to prioritize key areas. However, due to the urbanized nature of the watershed (particularly adjacent to riparian areas) and flooding concerns, it is anticipated that most LWD structures will require engineering. Cost based on treating 10 miles of stream (assume 1 project/mile in 50% High IP) at a rate of $29,440/mile. If ELJ used instead, cost estimated to be $1,152,768. Cost accounted for in another action step (see hydrology).

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid rearing habitats in the San Gregorio Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CDFW, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						0	Manipulation of LWD should not occur until evaluated by the San Mateo County Planning staff and hydrologist and/or qualified biologist familiar with Central Coast streams. LWD target could likely be achieved in a relatively short time period of existing and newly recruited large wood was left intact by landowners. Cost savings would be significant. Currently a significant amount of large woody material was removed without proper authorization in the watershed. Action is considered In-Kind
SGC-CCCS-6.1.1.4	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	2	50	CDFW, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						0	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Winter habitat has been degraded for salmonids in part from a lack of LWD, which provides important slow-water refuge areas during high flow events (Stillwater Sciences et al. 2010). Steelhead summer habitat has also been degraded by the lack of LWD, which helps to form pools where salmonids can over-summer, and provides cover and protection from predators. □ □ Winter habitat has been degraded for both coho salmon and steelhead and Winter habitat LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should be implemented and designed to provide cover, and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated to threaten adjacent infrastructure. Action is considered In-Kind
SGC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	100	CDFW, IWRP, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						0	This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. CDFW stream surveys indicate a lack of LWD within the San Gregorio Creek watershed where all but one stream ranked as "poor". Low LWD abundance within San Gregorio Creek is likely the result of past logging practices that removed trees from riparian areas and stream clearance efforts. The lack of LWD likely is the major contributor to the lower shelter values estimated in the watershed (an average rating of 0 out of a possible total of shelter of 300). Reduced large wood and shelter adversely affect the summer, winter, and smolt life stages in San Gregorio Creek. Action is considered In-Kind
SGC-CCCS-6.1.1.6	Action Step	Habitat Complexity	Encourage San Mateo County to initiate large instream wood structure tracking in key stream reaches where unauthorized large woody material is commonly modified or removed.	2	10	San Mateo County	20.00	20.00				40	Tracking efforts will provide greater certainty to regulatory agencies and land owners in regard to potential threats and benefits posed by instream woody debris. Additional funding for staff will likely be necessary to implement this recommendation.

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-6.1.1.7	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CDFW, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE	335.00	335.00				670	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely or insignificant to downstream reaches. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost based on treating 5 miles (assume 80 acres/mile in 25% High IP) at a rate of$1,674.
SGC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelter ratings										
SGC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	100								
SGC-CCCS-6.1.2.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFW, County of San Mateo, USACE						0	Action is considered In-Kind
SGC-CCCS-6.1.2.3	Action Step	Habitat Complexity	Identify historical steelhead habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	1	30	CDFW, County of San Mateo, FEMA, NOAA RC, NRCS, San Mateo RCD, USACE, USFWS							Costs cannot be determined at this time. A limiting factors analysis may help to refine costs. NHI (2010) predicted that overwintering habitat may be a significant limiting factor for steelhead survival in stream reaches. Efforts to increase high water refugia should be targeted in reaches with high IP values as an immediate action to increase survival. These efforts should not be precluded while awaiting for a watershed analysis to be completed.
SGC-CCCS-6.1.2.4	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CDFW, County of San Mateo, FEMA, Mid Peninsula Open Space District, MROSD, NMFS PRD, NRCS, POST, Private Landowners, RWQCB, San Mateo RCD, USACE						TBD	Project costs cannot be estimated at this time because the number of future stream bank protection projects is unknown and cannot be reasonably predicted. Costs can vary significantly depending on access and type of project.
SGC-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality (embeddedness)										
SGC-CCCS-8.1.1.1	Action Step	Sediment	Encourage San Mateo to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	2	100	Private Landowners, San Mateo County						TBD	Cost are dependent on market value and property turnover.

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-8.1.1.2	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Gregorio Creek.	3	100	CDFW, IWRP, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						TBD	Extent of bank failures are unknown. Repairs should be completed using bioengineering techniques and material, where appropriate. Habitat enhancement should be incorporated into the engineering design, where appropriate. The San Gregorio Creek Watershed Information Center includes six detailed and relatively recent inventories of bank erosion, landslide, and road-related fine sediment supply areas located primarily on Mid-peninsula Open Regional Open Space District and San Mateo County properties. In addition, the San Mateo County RCD is conducting additional assessments and geospatial analysis of roads in the watershed as part of its Rural Roads Program. Implementing the high priority recommendations for treatment in these inventories is a logical and cost-effective way to remediate known sources of fine sediment.
SGC-CCCS-8.1.2	Recovery Action	Sediment	Improve instream gravel quality										
SGC-CCCS-8.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalTrans, Mid Peninsula Open Space District, NRCS, POST, RWQCB, San Mateo County, State Parks						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels. Sites should be located on smaller tributaries or first order streams.
SGC-CCCS-8.1.2.2	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	3	100	CalFire, CalTrans, Mid Peninsula Open Space District, NRCS, Pescadero Municipal Advisory Council, Private Landowners, RWQCB, San Mateo County, State Parks, USACE						TBD	In a study on the San Lorenzo River in Santa Cruz County, Balance Hydrologics found stream reaches with a total of 1.5 to 2 bankfull widths (on both banks) of healthy native riparian vegetation offer the best instream habitat and have the most stable banks (Balance Hydrologics 1998). These riparian width recommendations are also appropriate for San Gregorio and would facilitate return of watershed processes to properly functioning conditions.
SGC-CCCS-8.1.2.3	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	100	Farm Bureau, NRCS, RWQCB, San Mateo County, San Mateo RCD						0	Excessive sediment transport rates in the San Gregorio watershed have compromised spawning and rearing habitat. Pool filling appears to result from upslope erosion, and has been noted to reduce available habitat throughout the San Gregorio Creek watershed since the 1970s (Titus et al., 2010). Action is considered In-Kind
SGC-CCCS-8.1.2.4	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, FEMA, NMFS, NRCS, RWQCB, San Mateo County, USACE, USFWS						0	While costs are involved in this recommendation, inspections should be considered a standard business practice by all regulatory agencies and this action should not be considered as an additional cost.
SGC-CCCS-8.1.2.5	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 salmonid recovery priorities.	3	10	CDFW, Farm Bureau, NRCS, Private Landowners, San Mateo RCD						0	Evaluate and adopt programs such as the Fish Friendly Farming Program. Action is considered In-Kind
SGC-CCCS-10.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-10.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-10.1.1.1	Action Step	Water Quality	Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	100	RWQCB, San Mateo County, San Mateo County RCD						0	Action is considered In-Kind
SGC-CCCS-10.1.1.2	Action Step	Water Quality	Evaluate water quality San Gregorio watershed to isolate sources on nitrogen and E. coli, fecal coliforms, and total coliforms.	3	10	IWRP, RWQCB, SGERC	11.50	11.50				23	Sources of input may include leaky septic systems, wild or domestic animals, and/or poorly managed horse and livestock facilities. Cost based on water quality monitoring at an annual rate of $763/site for a minimum of 3 sites.
SGC-CCCS-10.1.2	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
SGC-CCCS-10.1.2.1	Action Step	Water Quality	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	CalFire, CalTrans, Private Landowners, RWQCB, San Mateo County, USACE, USEPA						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.
SGC-CCCS-10.1.2.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10	CalFire, Farm Bureau, NRCS, Private Landowners, RWQCB, San Mateo County, San Mateo RCD						0	Action is considered In-Kind
SGC-CCCS-10.1.2.3	Action Step	Water Quality	Encourage San Mateo County to establish wider riparian buffers in residential and urban areas.	2	10	CDFW, NMFS, Private Landowners, RWQCB, San Mateo County, San Mateo County RCD, USEPA, USFWS						0	This will likely be a sensitive issue for many landowners with property located next to riparian areas. This recommendation should be applied to all new development projects. Action is considered In-Kind
SGC-CCCS-10.1.2.4	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100	Farm Bureau, Private Landowners, San Mateo County, San Mateo RCD						0	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort. Action is considered In-Kind
SGC-CCCS-10.1.3	Recovery Action	Water Quality	Improve stream water quality conditions										
SGC-CCCS-10.1.3.1	Action Step	Water Quality	Evaluate water quality below likely sources of contamination.	2	10	IWRP, RWQCB, San Mateo County, USEPA	12.50	12.50				25	Sources of input may include leaky septic systems, nursery effluent, wild or domestic animals, and/or poorly managed horse and livestock facilities. The San Gregorio Creek watershed is currently listed as impaired for bacteria and sediment under Section 303(d) of the Clean Water Act (SFBRWQCB, 2006). Water temperature was considered suboptimal; temperatures thresholds for juvenile coho salmon, which are lower than those for steelhead, were exceeded at some of the sampling locations according to information presented in the San Gregorio Creek Watershed Management Plan (NHI 2010). NMFS determined setting temperature thresholds based on the more narrow range of coho salmon thermal requirements was appropriate for watersheds with co-occurring populations of CCC coho salmon and CCC steelhead. Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume minimum 5 for San Gregorio Creek. Cost does not account for maintenance or data management.

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-10.1.3.2	Action Step	Water Quality	Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals into watercourses.	2	25	County DA, Law Enforcement, Public, Sheriff Department						0	Action is considered In-Kind
SGC-CCCS-10.1.3.3	Action Step	Water Quality	Review Roads, Sediment, Residential and Commercial Development, and Water Diversion strategies for additional recommendations.										
SGC-CCCS-10.1.4	Recovery Action	Water Quality	Improve stream temperature conditions										
SGC-CCCS-10.1.4.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade.	3	20	CalFire, California Coastal Conservancy, CDFW, County of San Mateo, Farm Bureau, NMFS, NRCS, Private Landowners, San Mateo RCD, USACE, USFWS	170	170	170	170		680	The fiscal costs of riparian revegetation or planting depend on the complexity of the project undertaken, the remoteness of the parcel of land to be treated, and the degree of site preparation needed. According to CDFG 2004, Evergreen Funding Consultants suggest a budget of between 5,000 dollars and 135,000 dollars per acre. Areas where this practice should be targeted would include lower mainstem reaches where the canopy is most impaired. Cost based on treating 0.4 mile (assume 5% high IP with 20 acres/mile) at a rate of $84,936/acre.
SGC-CCCS-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										
SGC-CCCS-11.1.1.1	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	2		California Coastal Conservancy, CDFW, NMFS						TBD	
SGC-CCCS-11.1.1.2	Action Step	Viability	Measure or estimate the condition of key attributes across the watershed.	2		California Coastal Conservancy, CDFW, NMFS						TBD	
SGC-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.	2	15	California Coastal Conservancy, CDFW, FishNet 4C, NMFS, NRCS, San Mateo County, San Mateo RCD, Trout Unlimited, USFWS						TBD	All assessments should use standardized methods. Methods should be consistent across the CCC DPS or at a minimum the Santa Cruz Mountains Diversity Stratum. Results from past assessments can be used in some circumstances to jump start restoration actions and need not necessarily wait upon completion of a standardized assessment protocol.
SGC-CCCS-11.1.1.4	Action Step	Viability	Monitor population status for response to recovery actions.	3	12	California Coastal Conservancy, CDFW, NMFS	54.58	54.58	21.83			131	Primary emphasis for monitoring should be placed on adult assessments. All efforts should be closely coordinated for survey efforts within the Santa Cruz Mountains to minimize duplication and ensure consistency of results. Priority ranking may change if San Gregorio is determined to be an optimal watershed in regional sampling. Priorities for sampling should be coordinated with coho sampling efforts. While San Gregorio is considered to be an Independent population only the San Lorenzo and Pescadero are considered to have Independent populations for CCC coho salmon in the Santa Cruz Mountains Diversity Stratum. Due to this ranking, it is likely Pescadero and San Lorezno will carry greater importance in a regional sampling effort. Cost based on fish/habitat restoration monitoring at a rate of $130,941/project

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-12.1	Objective	Agriculture	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize impairment to floodplain connectivity (impaired quality and extent)										
SGC-CCCS-12.1.1.1	Action Step	Agriculture	Maintain properly functioning conditions, and do not allow further degradation, of floodplain extent and connectivity.	1	100	San Mateo County						0	Action is considered In-Kind
SGC-CCCS-13.1	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SGC-CCCS-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Geological Survey, CalTrans, CDFW, FEMA, RWQCB, San Mateo County						In- Kind	Eliminating gabion baskets will result in long-term cost savings due implementation of longer lasting and better engineered solutions.
SGC-CCCS-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	100	California Geological Survey, CalTrans, CDFW, FEMA, RWQCB, San Mateo County						0	This recommendation should be adopted as a standard business practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation. Action is considered In-Kind
SGC-CCCS-13.1.1.3	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	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Public, RWQCB, San Mateo County, San Mateo RCD						0	This should become a standard business practice for all agencies and consulting firms engaged in constructing and designing solutions to address channel stability.
SGC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
SGC-CCCS-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.	2	100	California Geological Survey, CalTrans, CDFW, FEMA, RWQCB, San Mateo County						0	Action is considered In-Kind
SGC-CCCS-13.1.3	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCCS-13.1.3.1	Action Step	Channel Modification	Remove or modify structures impairing or reducing the historical feeding and salt water transition habit where feasible and benefits to rearing steelhead and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism with modification of culvert identified in Stillwater Sciences et al. (2010) upstream of the Highway 1 Bridge.	3	10	CA Coastal Commission, CalTrans, CDFW, IWRP, NMFS, San Mateo County, San Mateo RCD, State Parks, USACE, USFWS						TBD	Questions remain regarding the benefits of the action to improving conditions to the now-dewatered marsh as identified by Stillwater Sciences et al. (2010) and Smith (1987). Additional benefits may be accrued for tidewater goby and USFWS should be closely consulted. Benefits to salmonids may include additional winter high water refugia and additional sources of food production for salmonids rearing in the lagoon.

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-13.2	Objective	Channel Modification	Address the inadequacy of existing regulatory mechanisms										
SGC-CCCS-13.2.1	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCCS-13.2.1.1	Action Step	Channel Modification	Modify county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historical steelhead watersheds.	2	100	San Mateo County						0	Action is considered In-Kind
SGC-CCCS-14.1	Objective	Disease/ Predation/ Competition	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity										
SGC-CCCS-14.1.1.1	Action Step	Disease/ Predation/ Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.	3	10	Private Landowners, San Mateo RCD	157.50	157.50				315	Cost based on removing invasive exotic vegetation in 0.4 miles (assume 80 acres/mile in 5% High IP) at a rate of $984/acre.
SGC-CCCS-15.1	Objective	Fire/Fuel Management	Address the inadequacies of existing regulatory mechanisms										
SGC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SGC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire						0	Action is considered In-Kind
SGC-CCCS-15.2	Objective	Fire/Fuel Management	Address other natural or manmade factors affecting the species continued existence										
SGC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SGC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various salmonid life stages.	2	100	CalFire						0	Action is considered In-Kind
SGC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, San Mateo County, San Mateo RCD						0	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
SGC-CCCS-15.2.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, San Mateo County, San Mateo RCD						0	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Some areas in the San Gregorio watershed have high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, higher stream temperatures, which are already above optimal condition along the mainstem, would likely result. Action is considered In-Kind
SGC-CCCS-15.2.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						0	Action is considered In-Kind
SGC-CCCS-15.2.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the watershed (and all other watersheds in the County).	2	100	CalFire						0	Action is considered In-Kind

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
SGC-CCCS-15.2.2.1	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	2	50	CalFire, San Mateo County, San Mateo RCD						0	Some areas in the San Gregorio watershed have a high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures, which are already above optimal condition along the mainstem, would likely result. Action is considered In-Kind
SGC-CCCS-15.2.2.2	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, San Mateo County, San Mateo RCD						0	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire. Action is considered In-Kind
SGC-CCCS-15.2.2.3	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, San Mateo RCD, and regulatory agencies with expertise in fisheries issues.	2	3	CalFire, County of San Mateo, FishNet 4C, NMFS, San Mateo RCD, USFWS						0	Action is considered In-Kind
SGC-CCCS-15.2.2.4	Action Step	Fire/Fuel Management	Disseminate plan to all local fire fighting agencies.	2	10							0	Action is considered In-Kind
SGC-CCCS-15.2.2.5	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	2								97	Cost based on effects of wildfire on aquatic ecosystems monitoring at a rate of $96,678/project.
SGC-CCCS-15.2.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SGC-CCCS-15.2.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire							Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
SGC-CCCS-15.2.4	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SGC-CCCS-15.2.4.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC steelhead.	2	60	CalFire						0	This recommendation should be adopted in areas where life and infrastructure and not endangered by fire. Action is considered In-Kind
SGC-CCCS-15.2.4.2	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	2	100	CalFire, CDFW, NMFS						0	Guidance could include informing CalFire of sensitive biological resources in the watershed as well as recommendations regarding sensitive watersource location (e.g., San Gregorio lagoon). Action is considered In-Kind
SGC-CCCS-15.2.5	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
SGC-CCCS-15.2.5.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	5	CalFire, CDFW, NMFS, USFWS						0	Action is considered In-Kind
SGC-CCCS-22.1	Objective	Residential/ Commercial Development	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	New development in all historical steelhead watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.	2	100	RWQCB, San Mateo County						0	Action is considered In-Kind
SGC-CCCS-22.1.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SGC-CCCS-22.1.2.1	Action Step	Residential/ Commercial Development	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a steelhead watercourse.	2	100	FEMA, Private Landowners, San Mateo County						0	A shallow landslide model predicted about 4.4% of the watershed as chronic or high instability in the headwater regions of the El Corte de Madera, La Honda, and Mindego Creek sub-basins. Stringent review by permitting agencies is expected to reduce ancillary costs associated with poorly planned and poorly located developments. Priority areas that should be avoided include the estuary and geologies with steep mixed lithology and the sandstone geologies in the watershed. Action is considered In-Kind
SGC-CCCS-22.1.2.2	Action Step	Residential/ Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	FEMA, Private Landowners, San Mateo County							Functional buffers provide multiple benefits to water processes. Buffers in residential areas frequently become compromised overtime due to encroachment issues.
SGC-CCCS-22.1.2.3	Action Step	Residential/ Commercial Development	Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100	FEMA, Private Landowners, San Mateo County						0	General recommendation that should be applied to all pre existing and future landuse activities in the watershed. This recommendation should be considered standard practice. Action is considered In-Kind
SGC-CCCS-22.1.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCCS-22.1.3.1	Action Step	Residential/ Commercial Development	Design new development to allow streams to meander in historical patterns.	1	100	FEMA, Private Landowners, San Mateo County						0	Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations. Action is considered In-Kind
SGC-CCCS-22.1.3.2	Action Step	Residential/ Commercial Development	Encourage County planning departments to designate special assessment districts for properties with infrastructure located in high risk flood prone zones. Revenue generated should be used to raise or relocate infrastructure away from high risk flood zones.	3	20	FEMA, Private Landowners, San Mateo County						0	Protection of floodplains is critical for juvenile salmonids, particularly during the winter high flow period. Restoration of floodplains is typically very expensive when subject to development pressures. Action is considered In-Kind
SGC-CCCS-22.1.3.3	Action Step	Residential/ Commercial Development	Evaluate watershed for infrastructure at high risk of flooding.	2	10	FEMA, Private Landowners, San Mateo County						0	Most of these structures have likely been identified. Action is considered In-Kind
SGC-CCCS-22.1.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance										
SGC-CCCS-22.1.4.1	Action Step	Residential/ Commercial Development	Promote infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	RWQCB, San Mateo County						0	This action encourages implementation of many existing policies. The 2000 census estimated the population within San Gregorio Creek at 2,458 individuals; six percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009), with the majority of the development located in close proximity to the various watercourses. Although the population in the watershed in relatively low compared to many other watersheds in the ESU, the proximity of residences to stream channels places riparian areas and stream channels at greater risk for future alteration. Action is considered In-Kind
SGC-CCCS-22.1.4.2	Action Step	Residential/ Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	1	100	County of San Mateo, Mid Peninsula Open Space District, POST						TBD	Cost depend on market value, landowner participation, and turnover.
SGC-CCCS-22.1.5	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SGC-CCCS-22.1.5.1	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.	3	100	County of San Mateo, NRCS, POST, Private Landowners, Public, RWQCB, San Mateo RCD, USACE						0	Action is considered In-Kind
SGC-CCCS-22.2	Objective	Residential/ Commercial Development	Address the inadequacy of existing regulatory mechanisms										
SGC-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
SGC-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	3	5	Public, RWQCB, San Mateo County						0	San Mateo County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs. mainstem. Action is considered In-Kind
SGC-CCCS-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SGC-CCCS-22.2.2.1	Action Step	Residential/ Commercial Development	Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	3	100	Public, RWQCB, San Mateo County						0	Costs are considered part of RWQCB existing authority and obligation.
SGC-CCCS-22.2.2.2	Action Step	Residential/ Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	3	100	RWQCB, San Mateo County, USEPA						0	Action is considered In-Kind
SGC-CCCS-22.2.2.3	Action Step	Residential/ Commercial Development	Evaluate regulation of commercial transportation of hazardous chemical along Highway 84.	3	10	CalTrans, County of San Mateo, RWQCB, USEPA						0	Evaluation should include an analysis of potential risk in regards to commonly transported chemicals and overall road conditions (road barriers etc.). Action is considered In-Kind
SGC-CCCS-22.2.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to watershed hydrology										
SGC-CCCS-22.2.3.1	Action Step	Residential/ Commercial Development	Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.	3	10	CDFW, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						0	Action is considered In-Kind
SGC-CCCS-22.2.3.2	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.	1	100	County of San Mateo, NMFS, Public, SWRCB						0	Costs are considered part of SWRCB existing authority and obligation.
SGC-CCCS-22.2.3.3	Action Step	Residential/ Commercial Development	Modify all County General Plans to eliminate provisions allowing new construction in undeveloped areas within the 100-year flood prone zones in all historic CCC coho salmon and CCC steelhead watersheds.	2	10	County of San Mateo						0	Costs should be minimal if incorporated into updated county general plans.
SGC-CCCS-22.2.3.4	Action Step	Residential/ Commercial Development	New development in all historical CCC steelhead watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.	3	100	County of San Mateo, RWQCB						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SGC-CCCS-22.2.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance										

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SGC-CCCS-22.2.4.1	Action Step	Residential/ Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	100	San Mateo County						0	Action is considered In-Kind
SGC-CCCS-22.2.4.2	Action Step	Residential/ Commercial Development	Discourage San Mateo County from rezoning forestlands to rural residential.	1	100	County of San Mateo						0	Action is considered In-Kind
SGC-CCCS-22.2.4.3	Action Step	Residential/ Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CDFW, Mid Peninsula Open Space District, MROSD, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC						0	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality, increased rates of sedimentation, future consequences of flood fighting to riparian zones and bank hardening, etc. The adverse impacts of extensive rural residential development in the San Lorenzo River watershed is reflected in high rates of sedimentation and water diversion. Action is considered In-Kind
SGC-CCCS-22.2.4.4	Action Step	Residential/ Commercial Development	Encourage San Mateo County to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	2	100	County of San Mateo, FEMA, NMFS, Private Landowners, SGERC						0	Action is considered In-Kind
SGC-CCCS-22.2.4.5	Action Step	Residential/ Commercial Development	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).	2	100	County of San Mateo, FEMA, POST, Private Landowners, RWQCB						0	
SGC-CCCS-22.2.5	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCCS-22.2.5.1	Action Step	Residential/ Commercial Development	County 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	20	San Mateo County						0	Many residences and properties in the San Gregorio watershed are prone to flooding, and efforts to minimize the impacts of flooding will likely include removing instream habitat features such as wood debris (a practice that has occurred in the past). Residences located adjacent to stream channels are often at increased risk of bank erosion, and efforts to protect existing infrastructure will likely include bank stabilization efforts that could further degrade salmonid habitat. Action is considered In-Kind
SGC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										
SGC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, CalTrans, Private Landowners, San Mateo County						0	All new and replacement culverts should be sized to accommodate a 100 year flow event. Action is considered In-Kind

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SGC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or steelhead watersheds.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	46.00	46.00	46.00	46.00		184	This recommendation will be difficult to implement due to the extensive development in the watershed and topographical confinement. Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards. Targeted areas should include sub watersheds with high erosion potential. Many of the former logging roads in the upper portion of the watershed are now used as recreational trails by mountain bikers. These trails are often very steep and contribute substantial fine sediment to San Gregorio Creek due to inadequate maintenance practices and poor trail locations (Ambrose, pers. obs. 2002). A shallow landslide model predicted about 4.4% of the watershed as chronic or high instability in the headwater regions of the El Corte de Madera, La Honda, and Mindego Creek sub-basins. Repairing and decommissioning roads in areas predicted as chronically or highly unstable could reduce the likelihood of sediment input from areas predicted as chronically or highly unstable. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 13 miles of road network at a rate of $14,141/mile.
SGC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SGC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County						0	Action is considered In-Kind
SGC-CCCS-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	CalFire, CalTrans, IWRP, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, San Mateo RCD						TBD	On many forest and ranch roads, located on both public and private lands, periodic maintenance falls short of addressing chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossings can continue and even exacerbate the rate of fine sediment delivery to the stream channel. Additionally, paved and unpaved roads parallel many of the waterways within San Gregorio Creek, and may impinge channel migration. Cost accounted for in RESIDENTIAL/COMMERCIAL DEVELOPMENT.
SGC-CCCS-23.1.2.3	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	20	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County	775	775	775	775		3,100	Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater benefits to various lifestages. If bridges are not feasible, replacement culverts on fish bearing streams must have a natural bottom. Cost base on improving passage at 9 stream crossings (2 impassable, 7 temporary or partially impassable) at a rate of $744,882 for impassable and $254,278 for partially impassable.

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SGC-CCCS-23.1.2.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from steelhead streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	5	CalFire, CalTrans, RWQCB, San Mateo County, State Parks						TBD	Inadequate storage of sediment from road management has been an ongoing issue in San Gregorio watershed. The paucity of locations for temporary storage of landslide material is a significant constraint. Sites should be identified within the duration specified and this action should be continued in perpetuity. A significant amount of sediment is removed from inside ditches and road surfaces during winter months due to general erosion and removal of landslides and is temporarily deposited in areas with hydraulic connectivity to watercourses. Future efforts may require incentives to increase landowner participation. Cost dependent on identifying spoil storage sites and feasibility of meeting targets.
SGC-CCCS-23.1.2.5	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County						0	Roadside berms are common on many private and county roads in San Mateo County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails). Action is considered In-Kind
SGC-CCCS-23.1.2.6	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, State Parks						TBD	Road inventory should identify the number and extent of energy dissipaters needed.
SGC-CCCS-23.1.2.7	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, State Parks						0	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Action is considered In-Kind
SGC-CCCS-23.1.2.8	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, State Parks						TBD	Costs will vary depending on number of culvert upgrades occur on a road network and the inefficiency of the current drainage system. Pretreatment systems should be installed as part of new projects or upgraded. A maintenance plan should be part of all pretreatment systems.
SGC-CCCS-23.1.2.9	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. Seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalFire, CalTrans, FEMA, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, State Parks						TBD	Costs are difficult to accurately determine but it may result in a long term cost savings. San Mateo County should seek amendments to FEMA policies to facilitate improvements that prevent erosion and failure, particularly for watersheds targeted in this and the CCC coho salmon recovery plans.
SGC-CCCS-23.1.2.10	Action Step	Roads/Railroads	Encourage County to continue implementation of the San Mateo County Road Maintenance Manual.	2	100	San Mateo County						0	Action is considered In-Kind
SGC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, FEMA, IWRP, NRCS, San Mateo RCD, USACE							Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis. Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
SGC-CCCS-23.1.3.2	Action Step	Roads/Railroads	Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	100	CalFire, CalTrans, CDFW, FEMA, NOAA RC, NRCS, Private Landowners, RPFs, RWQCB, Santa Cruz County, Santa Cruz County Department of Public Works, Santa Cruz RCD, State Parks, USACE							Replacement of culverts/bridges and upgrading to NMFS standards will result in increased cost for materials and construction but will likely result in structures that can withstand large storm events better than many existing structures. This recommendation applies to all stream crossings, including those on Class 2-3 streams.
SGC-CCCS-23.1.3.3	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	1	10							0	This action step can largely depends upon state and federal regulatory agency staff. Action is considered In-Kind
SGC-CCCS-23.1.3.4	Action Step	Roads/Railroads	Replace problematic culverts and low flow crossings streams with bridges or appropriate cost effective designs.	2	50	CalFire, CalTrans, CDFW, County of San Mateo, MROSD, NOAA RC, POST, Private Landowners, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD, State Parks, USACE						TBD	Partial barriers are present in the San Gregorio watershed. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz County have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages.
SGC-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure										
SGC-CCCS-23.1.4.1	Action Step	Roads/Railroads	Encourage adoption and implementation of a plan similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities. This plan was developed to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalFire, CalTrans, FEMA, IWRP, Mid Peninsula Open Space District, NRCS, POST, San Mateo County, San Mateo RCD, USACE						0	Action is considered In-Kind
SGC-CCCS-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance										
SGC-CCCS-23.1.5.1	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	20	CalTrans, CDFW, City of Santa Cruz, City of Scotts Valley, FishNet 4C, Santa Cruz County, Santa Cruz RCD						0	Action is considered In-Kind

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-23.1.5.2	Action Step	Roads/Railroads	Continue training County Road Maintenance staff through the FishNet 4C program.	2	20	CalFire, CalTrans, County of San Mateo, FishNet 4C, RWQCB, San Mateo RCD						0	Action is considered In-Kind
SGC-CCCS-23.1.6	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SGC-CCCS-23.1.6.1	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	30	CalFire, CalTrans, County of San Mateo, Mid Peninsula Open Space District, MROSD, NRCS, POST, Private Landowners, Public, State Parks						TBD	A watershed wide inventory of the existing riparian road network will need to be conducted before a reasonable price estimate for this action is determined. Roads in urbanized areas (La Honda) will be very difficult to decommission; roads in more remote areas, particularly those historically used for timber harvest or in public ownership will likely be much easier to target for decommissioning.
SGC-CCCS-23.1.6.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	10		145.00	145.00				290	Cost based on conducting a road inventory of 156 miles of road network at a rate of $1,090/mile and a erosion assessment of 25% of total watershed acres at a rate of $14.39/acre.
SGC-CCCS-23.1.6.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	60	CalFire, CalTrans, County of San Mateo						0	This is a cost that is frequently absorbed into road projects.
SGC-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
SGC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SGC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Reduce sediment sources from road networks and other actions that deliver sediment to stream channels through improved or new laws and policy.	2	10							TBD	Cost based on amount of sediment delivered from road network in assessment. Treatment methods vary significantly.
SGC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Encourage County of San Mateo to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	San Mateo County							The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within San Gregorio Creek and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening.
SGC-CCCS-23.2.1.3	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific road management plan is created and implemented.	2	20	CalFire, CalTrans, County of San Mateo, FEMA						0	A well designed road management plan should result in long term cost savings. Action is considered In-Kind
SGC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CDFW, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, San Mateo County, USACE, USFWS						0	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions. Action is considered In-Kind
SGC-CCCS-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SGC-CCCS-23.2.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	100	CalFire, CalTrans, CDFW, Mid Peninsula Open Space District, NMFS, POST, Private Landowners, RPFs, RWQCB, San Mateo County						0	Standard business practice (In-Kind); however, implementation may be difficult in the watershed due to the large number of small landowners and varying degree of financial resources. County of San Mateo evaluated roads and trails and likely have a good idea of priority locations that should be addressed on an annual basis. Rural roads should receive the majority of the attention vs. mainline roads in the watershed.
SGC-CCCS-23.2.3.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	CalFire, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, RPFs, RWQCB, San Mateo County						0	This should be considered the minimum standard for dirt roads in the watershed. Action is considered In-Kind
SGC-CCCS-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	CalTrans, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County						0	Cost should be considered part of land owner road management plans. These standards should be adopted for all unsurfaced roads and trails in the San Gregorio watershed. Action is considered In-Kind
SGC-CCCS-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
SGC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SGC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	1	100	SWRCB						0	This should be considered an ongoing business practice but due to the constraints of the SWRCB from lack of staffing an indeterminate cost is associated with this recommendation. Action is considered In-Kind
SGC-CCCS-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity										
SGC-CCCS-24.1.2.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	2	100	CDFW, NMFS OLE						0	Action is considered In-Kind
SGC-CCCS-24.2	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
SGC-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SGC-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	FEMA, State Parks, USACE						0	Action is considered In-Kind
SGC-CCCS-24.2.1.2	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, State Parks, USACE						TBD	
SGC-CCCS-24.2.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SGC-CCCS-24.2.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions during drought conditions.	1	10	CDFW, Mid Peninsula Open Space District, NMFS, NMFS OLE, POST, Private Landowners, San Mateo RCD, SGERC, SWRCB	37.50	37.50				75	Due to the heavy overdraft of water resources from San Gregorio Creek, the impact of a severe drought could be devastating to all lifestages of coho salmon and steelhead in the watershed. Numerous diversions are located throughout the watershed in every major tributary. Although a water master is appointed, the required minimum bypass flows set by the Courts were not based on salmonid requirements. Severe drought, particularly if occurring over a period of two or more years, would likely adversely impact salmonid habitat throughout the watershed and reduce the overall carrying capacity of available habitat. Cost based on stream flow modeling at a cost of $74,195.
SGC-CCCS-24.2.2.2	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies during drought periods.	1	5	CDFW, NMFS, NMFS OLE, Private Landowners, SWRCB						0	The SWRCB should conduct periodic sweeps of diversions in San Gregorio Creek to ensure they are in compliance with annual reporting requirements and that annual water usage is accurately reported. Action is considered In-Kind
SGC-CCCS-24.2.2.3	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated through conservation programs.	2	20	CDFW, NMFS, NMFS OLE, Private Landowners, SWRCB						0	Action is considered In-Kind
SGC-CCCS-24.2.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SGC-CCCS-24.2.3.1	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	CDFW, NMFS, NMFS OLE, Private Landowners, SWRCB						0	Action is considered In-Kind
SGC-CCCS-24.2.3.2	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	2	5	CDFW, NMFS, NMFS OLE, Private Landowners, SGERC, SWRCB	10.00					10	Water temperatures during drought will be directly affected by ongoing surface water diversions in San Gregorio Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost based on temperature monitoring at a cost of $10,000.
SGC-CCCS-24.2.3.3	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in San Mateo County.	2	5	CDFW, NMFS, San Mateo County						0	Action is considered In-Kind

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SGC-CCCS-24.2.3.4	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalTrans, FEMA, Public, San Mateo County, USACE						0	Extreme flood events could result in major erosion within upslope locations. Much of the watershed is comprised of erodible geology that would likely impact spawning and rearing habitats when sediment enters the stream channel. Changes and improvements in land use practices will likely lower sediment yield rates following future flooding events. However, much of the watershed is considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions. Action is considered In-Kind
SGC-CCCS-24.2.3.5	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of steelhead in any flood management activity.	3	10	CalTrans, FEMA, Public, San Mateo County, USACE						0	Outreach and education are ongoing, and additional costs are expected to be minimal.
SGC-CCCS-24.2.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration										
SGC-CCCS-24.2.4.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	3	2	CDFW Law Enforcement, NMFS OLE						0	Action is considered In-Kind
SGC-CCCS-24.2.5	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCCS-24.2.5.1	Action Step	Severe Weather Patterns	Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.	3	10	CDFW, NMFS, San Mateo County						0	Action is considered In-Kind
SGC-CCCS-24.2.5.2	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						0	Action is considered In-Kind
SGC-CCCS-24.2.5.3	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						TBD	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. A lack of available winter refuge habitat, due in part to lack of access to inundated floodplain or off-channel habitats, has been identified as a limiting factor for coho salmon in the watershed according to Stillwater Sciences et al. (2010). This limiting factor for coho salmon is likely also a limiting factor for steelhead in the watershed, but to a lesser degree. According to Stillwater Sciences et al. (2010), the lower mainstem San Gregorio Creek historically may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. Mainstem channel and low gradient tributary reaches should be assessed to target opportunities to restore floodplain connectivity.
SGC-CCCS-24.2.5.4	Action Step	Severe Weather Patterns	Avoid or minimize the effects from flood control projects on salmonid habitat.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						0	Not building flood control projects will not incur expenses. Particular attention should be directed at ensuring substantial future infrastructure is not placed within the historical tidal prism of the estuary. Action is considered In-Kind
SGC-CCCS-24.2.5.5	Action Step	Severe Weather Patterns	Review Hydrology and Water Diversion and Impoundment recommendations.										
SGC-CCCS-25.1	Objective	Water Diversion/ Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SGC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SGC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair estuary water quality conditions for rearing juvenile salmonids.	1	100	CDFW, NMFS, San Mateo County, SWRCB						0	Aquatic conditions in San Gregorio Creek are likely adversely affected by water diversions -- the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board. Water diversions adversely impact the summer lifestage by reducing flows and available habitat for rearing and feeding in the riverine areas as well as the estuary. Water diversions also extend the duration necessary for conversion to a freshwater lagoon during the summer. Action is considered In-Kind
SGC-CCCS-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SGC-CCCS-25.1.2.1	Action Step	Water Diversion/ Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	100	CDFW, NMFS, San Mateo County, SWRCB						0	The San Gregorio watershed is adjudicated and a minimum bypass requirement of 2 cfs was established for new diversions. However, this requirement does not apply to existing water diversions, and flows are often less than 2 cfs in summer and fall (Stillwater Sciences et al. 2010). In addition, the CDFW Coho Recovery Plan (CDFG 2004) states that the prescribed bypass flows are too low to assure viable salmonid populations. A minimum bypass flow of five cfs should be applied to all water diversions, including existing and new wells, riparian pumping, and stream side wells. To reduce the amount of water diverted from the stream and pumped from the alluvial groundwater basin, and potentially maintain summer and fall instream flows, domestic, agricultural, and recreational water conservation strategies should be implemented (Stillwater Sciences et al.2010). Efforts to address the adverse impacts of water diversions could include increased oversight by the SWRCB (and County of San Mateo for ongoing monitoring groundwater wells) for permitted diversions, and enforcement of applicable laws for unpermitted diversions. Action is considered In-Kind
SGC-CCCS-25.1.2.2	Action Step	Water Diversion/ Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential steelhead streams that go dry in some years.	2	10	CDFW, Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD, SWRCB	37.50	37.50				75	Water diversions reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions. Water diversions are distributed throughout the watersheds many tributaries as well as the mainstem of San Gregorio Creek. These diversions, coupled with poor instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. Notable flow fluctuations are occasionally measured at the USGS San Gregorio stream gauge during low flow periods. For example, flows will drop from approximately one cfs to near zero over a period of a few hours and then return to one cfs several hours later. The cause of these fluctuations is unknown, and although specific effects on instream conditions have not been determined, they are suspected to be detrimental to fish and their habitat. The magnitude of this effect is not currently known, but during below-normal water years the available water supply can be insufficient to meet all the water rights allocated in the watershed and provide instream flows for aquatic species. Cost based on stream flow/precipitation model at a rate of $74,195/project.
SGC-CCCS-25.1.2.3	Action Step	Water Diversion/ Impoundment	Enforce stream flow bypass requirements for all authorized diversions in San Gregorio Creek and its tributaries.	1	100	CDFW, NMFS, SWRCB						0	A water master has been appointed in the San Gregorio watershed. In time, bypass requirements may change due to findings from instream flow studies. Action is considered In-Kind

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SGC-CCCS-25.1.2.4	Action Step	Water Diversion/ Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	100	CDFW, Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD, SWRCB						0	Action is considered In-Kind
SGC-CCCS-25.1.2.5	Action Step	Water Diversion/ Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids in San Gregorio Creek.	1	10		75.00	75.00				150	Significant monitoring efforts are currently occurring in the San Gregorio watershed. Data from this monitoring effort should be evaluated and incorporated into the stream flow evaluation program as a means to reduce overall costs. However, due to the large amount of water diverted and the poor condition of the fishery it is likely an IFIM study will be needed that focuses on necessary instream flows in multiple streams and stream reaches in San Gregorio. Evaluation should also account for freshwater input into the lagoon. Cost based on stream flow/precipitation gauge modeling at a rate of $74,195/project.
SGC-CCCS-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration										
SGC-CCCS-25.1.3.1	Action Step	Water Diversion/ Impoundment	Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in San Gregorio Creek.	3	100	CDFW, NMFS, Private Landowners, San Mateo County, SWRCB						TBD	Cost accounted in other action steps.
SGC-CCCS-25.1.3.2	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFW, NMFS, Private Landowners, SWRCB						TBD	An assessment of the number of unscreened or improperly screened diversions needs to occur first. Estimate for fish screen is $53,465/screen.
SGC-CCCS-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (impaired stream temperature)										
SGC-CCCS-25.1.4.1	Action Step	Water Diversion/ Impoundment	Work with recovery partners to ensure water diversions do not impair water temperatures in the San Gregorio Creek.	2	100	CDFW, Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD, SWRCB						0	As part of future streambed alteration agreement, CDFW should require installation of temperature thermographs upstream and downstream of the diversion. These results should be reviewed on a yearly basis by the SWRCB and CDFW. Action is considered In-Kind
SGC-CCCS-25.1.5	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to watershed hydrology										
SGC-CCCS-25.1.5.1	Action Step	Water Diversion/ Impoundment	Promote conjunctive use of water with water projects whenever possible to maintain or restore salmonid habitat.	2	100	California Coastal Conservancy, CDFW, County of San Mateo, Farm Bureau, FishNet 4C, Mid Peninsula Open Space District, MROSD, NMFS, NOAA RC, NRCS, POST, Private Landowners, San Mateo RCD, Trout Unlimited						TBD	Costs will vary significantly depending on landowner cooperation, infrastructure constraints, and types of infrastructure necessary to meet landowner needs. Due to the high degree of flow impairment in the watershed it is likely that significant infrastructure and coordination will be required to meet minimum flow requirements for steelhead viability and therefore, costs will be significant.

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SGC-CCCS-25.1.5.2	Action Step	Water Diversion/ Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	Farm Bureau, Gold Ridge RCD, Mid Peninsula Open Space District, NRCS, Trout Unlimited						TBD	This recommendation should be incorporated into all future regulatory reviews of water rights applications and streambed alteration agreements in the San Gregorio watershed. Infrastructure will likely consist of off stream storage facilities that are used to store winter flows. These devices in over allocated, while beneficial, must be carefully evaluated before installation. Due to the significant amount of over allocation in the watershed, the impact of off channel storage must be evaluated against potential impacts to channel forming flow events and migration requirements of adult salmonids. Estimate for off channel storage ranges from $100 to $25,000/site.
SGC-CCCS-25.2	Objective	Water Diversion/ Impoundment	Address the inadequacy of existing regulatory mechanisms										
SGC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SGC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	2	5	CDFW, SWRCB						0	Evaluate rates of compliance and overall impact of currently permitted diversion to coho salmon and steelhead survival and recovery. This should be adopted as a standard practice by CDFW. However, full implementation may be limited due to a lack of staffing. In this circumstance, other alternatives should be evaluated. Action is considered In-Kind
SGC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	100	County, Federal, NMFS, State, SWRCB						0	Aquatic conditions in San Gregorio Creek are adversely affected by water diversions -- the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board. Water management operations adversely impact almost all coho salmon and steelhead life-stages, particularly during drought conditions. Additionally, water diversions reduce freshwater inflow to the estuary and extend the duration necessary for conversion to a freshwater lagoon during the summer. Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in the San Gregorio lagoon by improving water quality. Costs are considered minor due to appointment of a water master per the adjudication. To reduce the amount of water diverted from the stream and pumped from the alluvial groundwater basin, and potentially maintain summer and fall instream flows, domestic, agricultural, and recreational water conservation strategies should be implemented (Stillwater Sciences et al. 2010). Efforts to address the adverse impacts of water diversions could include increased oversight by the SWRCB (and County of San Mateo ongoing monitoring for groundwater wells) for permitted diversions, and enforcement of applicable laws for unpermitted diversions. Action is considered In-Kind
SGC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Request the SWRCB conduct interagency consultation with CDFW, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFW, NMFS, SWRCB						TBD	
SGC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	100	CDFW, NMFS, San Mateo County, State Parks, SWRCB, USFWS						0	The number of individual landowners in the watershed who maintain groundwater wells for residential and irrigation water supply is not known. The total number of wells in the watershed between 2006 and 2008, as contained within San Mateo County Environmental Health Division (EHD) records, was estimated at 311 (Table 2-6). The majority of these (79%) are situated in the eastern half of the watershed, which primarily acts as an area of groundwater recharge to the basin aquifer in the valley. Action is considered In-Kind

San Gregorio Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Continue to prohibit new or increased summer diversions.	1	100	CDFW, SWRCB						0	This action may result in decreased economic development but information to assesses whether or not this may happen was unavailable. Action is considered In-Kind
SGC-CCCS-25.2.1.6	Action Step	Water Diversion/ Impoundment	Encourage use of the most recent update of NMFS' Water Diversion Guidelines.	2	100	Coastside Land Trust, County of San Mateo, Farm Bureau, FishNet 4C, Mid Peninsula Open Space District, NMFS, NRCS, POST, Private Landowners, San Mateo RCD, SWRCB, Water Agencies						0	Action is considered In-Kind
SGC-CCCS-25.2.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize reduced density, abundance, and diversity										
SGC-CCCS-25.2.2.1	Action Step	Water Diversion/ Impoundment	Work with SWRCB and landowners to improve survival and migration opportunities for all lifestages.	1	20	CDFW, County of San Mateo, Farm Bureau, NMFS, NRCS, San Mateo RCD, SGERC, Trout Unlimited						0	Costs cannot be determined at this time but may be significant and will require close coordination with NGOs, private landowners, regulatory and non regulatory agencies. Lagoon rearing habitat should also be evaluated.

San Lorenzo River Population

CCC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 3,200 adults
- Current Intrinsic Potential: 146.2 IP-km

Steelhead Abundance and Distribution

The San Lorenzo River is the largest watershed in Santa Cruz County and the largest watershed in the Santa Cruz Mountains Diversity Stratum. The most important fisheries resources in the watershed likely are contained in Branciforte (including lower Carbonera), Zayante (including Bean), Fall, Boulder, and Bear creeks and the lower mainstem (Boulder Creek to Paradise Park) of the San Lorenzo River (D.W. Alley & Associates *et al*. 2004). The San Lorenzo River has played a central role in the history of steelhead in Santa Cruz County (Titus *et al*. 2010), and in 1954, it was considered the best winter steelhead stream south of San Francisco Bay (Becker and Reining 2008). In the 1940s, steelhead used an estimated 125 km of stream for spawning in the main stem and tributaries (Titus *et al*. 2010). The 1965 Fish and Wildlife Plan for California states there "… are 239 miles of steelhead habitat in the San Lorenzo drainage" (California Department of Fish and Game [CDFG] 1965). In 1965, CDFG estimated the annual steelhead spawning run in the San Lorenzo River at about 23,000 fish, based on the observations of local field personnel (Titus *et al*. 2010). This estimate did not differentiate between wild and hatchery origin fish, and the estimate is believed to be high by some local fishery biologists (Alley, personal communication 2002). In 2001, D.W. Alley & Associates (2002) estimated the current adult index of steelhead returns to the San Lorenzo River mainstem and nine tributaries at 610 and 1,000, respectively.

D.W. Alley & Associates *et al*. (2004) notes two "functional regimes" in the San Lorenzo River system, the first being the lower and middle mainstem downstream from the Boulder Creek confluence and the second comprising the upper mainstem and tributaries. According to the D.W. Alley & Associates *et al*. (2004) report, "…results suggest that smolts leaving the system each year are mostly a combination of large YOYs from the middle and lower river and yearlings from the tributaries and upper mainstem River." The large YOY from the middle and lower mainstem are highly dependent upon good stream flows to provide for fast-water feeding habitat necessary for faster growth.

Average density of juvenile steelhead for all size classes at mainstem San Lorenzo River monitoring sites in 1997-2001 and 2003-2013 ranged from 4.8 to 52.0 fish per 100 feet of stream (D.W. Alley & Associates 2013). Young-of-the-year ranged from 2.8 to 49.3, yearlings and older ranged from 0.8 to 9.6; size class I (<75 mm standard length, SL) ranged from 0 to 32.5, and size class II/III (≥ 75 mm SL) ranged from 4.3 to 43.9 fish per 100 feet of stream. Average density of juvenile steelhead for all size classes at San Lorenzo River tributary monitoring sites in 1997-2001 and 2003-2013 ranged from 5.0 (lower Branciforte Creek) to 104.5 (Zayante Creek) fish per 100 feet of stream (D.W. Alley & Associates 2013). In the lagoon, the juvenile steelhead population was estimated at 4,277 in August 2005, and 5,452 in September 2005, a wet year (Beck *et al*. 2006).

History of Land Use

Extensive alteration of stream environments within the San Lorenzo River watershed had regionally occurred prior to and during the early 20th century (SHG *et al.* 2002). Numerous human industries and developments clearly had dramatic impacts on the ability of local stream and riverine ecosystems to support salmonids. Chief among these development activities was the logging of the redwood forest in the Santa Cruz Mountain region (Rood 1975; McCarthy 1994; Spence *et al.* 2011; SLVWD 2009). Significant logging began in the Santa Cruz Mountains in the 1840s with the advent of water-powered, mechanized mills (prior to this time, logging was done using non-mechanized methods). In 1842, large-scale industrial logging began with the development of the region's first water-powered sawmill which was located in the San Lorenzo River watershed (Spence *et al.* 2011). The water-powered mills required the damming of streams and rivers to provide the necessary head for power and storing logs.

The 1870s saw the emergence of steam-powered sawmills and "steam donkeys." Additionally, rail systems were developed in the watershed to haul logs to mill sites (Rood 1975; Spence *et al.* 2011). These technological advances accelerated the pace of logging, and the period from 1875 to 1905 marked the apex of the logging industry in the Santa Cruz Mountains. The cumulative magnitude and spatial extent of early logging was impressive, as evidenced by the number of mill sites established before 1906 – some 130 in the San Lorenzo River watershed during the period 1840 to 1905. The rapidity with which the redwood forests of the Santa Cruz Mountains were logged was profound, and by the early 1900s, the timber supply in many watersheds was exhausted. The impacts of these early logging operations on salmonid habitat were undoubtedly severe.

Logging was not the only industry in the Santa Cruz Mountain area substantially, adversely affecting the capacity of streams to produce salmonids at their intrinsic potential during the

1800s. For example, between 1843 and 1870, several tanneries were established in the region, which made use of bark from tanoak (SLVWD 2009; Spence *et al.* 2011). The first of these was built in what is now known as Scotts Valley in the San Lorenzo watershed in 1843. Other industries that likely impacted aquatic habitat also included the California Powder Works and paper mills. The California Powder Works, established in 1861 and operated until 1914, manufactured black gunpowder for use in mines and railroad development in California. The plant was located near Paradise Park on the lower mainstem of the river. There were also several paper mills in the region. The San Lorenzo Paper Mill, which operated intermittently from 1861 to 1872, was located on the San Lorenzo River just downstream of the California Powder Works site.

Tourism expanded in the early 20th century, leading to the construction of many summer cabins and camps in the Santa Cruz Mountains. With the expanded urban growth of the 1950s and 1960s, many seasonal residences were converted to year-round residences, triggering urbanization of the San Lorenzo Valley. Growth brought more rural roads and more disturbed lands and greater erosion and sediment production to a watershed that was still recovering from late 19th century/early 20th century logging. Aggregate quarries in the watershed expanded to supply building materials to the region, and timber production occurred in predominantly second growth forests.

The surface area of the San Lorenzo River lagoon has been reduced by over 80 percent, dramatically simplifying the morphologic complexity of the lower San Lorenzo River lagoon (SHG *et al.* 2002, Beck *et al.* 2006). Following the 1955 flood, the estuary was channelized and leveed for flood control by the Corps. The flood control project resulted in the deepening and narrowing of the channel and removal of all riparian vegetation along the estuary[1]. Alterations to the lagoon significantly reduced the areal extent of rearing habitat for summer rearing juvenile salmonids.

Current Resources and Land Management

Most of the watershed is rugged mountainous terrain and is densely forested (Northern Santa Cruz County Integrated Regional Water Management Plan 2005). Flow from the San Lorenzo River Watershed along with groundwater resources provides 60-80 percent of the water supply for the City of Santa Cruz system and is a key supply for the communities of the San Lorenzo Valley.

[1] In more recent years, the City of Santa Cruz has encouraged the presence of some native vegetation within portions of the leveed San Lorenzo River between Highway 1 and Laurel Street to improve riparian habitat conditions.

Major land uses in the watershed are forest, urban, openland, recreation, agriculture and water (Northern Santa Cruz County Integrated Regional Water Management Plan 2005). The San Lorenzo River watershed supports residential land use, including rural and mountain residential zoning, timber harvest, and a mix of commercial and special districts. The lower portion of the watershed is more urbanized (e.g., City of Santa Cruz), while land use in the upper watershed consists predominantly of rural residential, forest and openland. Extensive residential development is located in close proximity to the bankfull channel on the lower mainstem (e.g., City of Santa Cruz) and middle mainstem (e.g., Felton and Boulder Creek) of the river and many of the tributaries (including Zayante, Bean, and Boulder creeks).

Salmonid Viability and Watershed Conditions

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

Current Conditions

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

Population and Habitat Conditions

Estuary: Quality & Extent

Estuaries constitute highly variable, large scale ecotones (transition zones between different environments) through which salmonids must pass as outmigrating juveniles and returning adults. Passage and rearing of juveniles in estuarine habitats are an integral phase of salmonid life history at a time when physiological adaption, foraging, and refugia from predators are critical (Healey 1982; Simenstad *et al.* 1982). Rearing in estuarine habitats contributes to the survival and fitness of juvenile salmonids throughout their life history (Kotyk *et al.* 1986; Bond *et al*. 2008). Because estuaries are natural carbon sinks, the food webs are detritus driven and much less dependent on seasonal primary production, resulting in greater productivity and better fish growth year round (Simenstad and Salo 1982). Due to emigration of rearing juveniles downstream seeking available habitat (Bjornn 1971), significant percentages of the juvenile population can end up rearing in coastal lagoons and estuaries (Zedonis 1992, Shapavalov and Taft 1954). Estuaries/lagoons on California's central coast have been extensively documented as

superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond *et al*. 2008). Smith (1990) documented that steelhead juveniles grew very rapidly in numerous lagoons in the Santa Cruz Mountain Diversity Stratum. Benefits associated with a functional lagoon environment (e.g., increased growth and probability of ocean survival) are compromised when (1) lagoons prematurely breach prior to adequate upstream flows from winter storm events, (2) inadequate water quality and quantity are available to facilitate freshwater conversion during the summer and fall, and (3) habitat availability is reduced and essential habitat attributes are simplified. The San Lorenzo River estuary/lagoon is significantly degraded by these three limiting factors. The impaired condition of the lagoon/estuary may be one of the most important limiting factors for the steelhead population in the watershed and viability of steelhead within the Diversity Stratum.

The San Lorenzo estuary was reduced in size following urban development and flood control efforts (by approximately 80% of its historical size), which led to degraded rearing conditions for juvenile salmonids. Urban development from the late 1800s to 1955 filled in the historical tidal prism, narrowing the river bed (Swanson Hydrology & Geomorphology *et al*. 2002). Following predictable high flow events that led to flooding in the City of Santa Cruz in 1955, the lower San Lorenzo River was leveed, straightened, and deepened (below sea level in some reaches). All the riparian vegetation was removed and the stream banks were hardened with rip rap (Mount 1995). The lagoon and estuary were narrowed considerably by the levee project, and a large island was eliminated (Swanson Hydrology & Geomorphology *et al*., 2002). These alterations reduced the quantity and quality of available estuarine habitat important for juvenile salmonid rearing.

Water quality data collected in the lagoon reveal degraded water quality parameters that likely adversely affect juvenile steelhead. Swanson Hydrology & Geomorphology *et al*. (2002) reported very low dissolved oxygen levels and water temperatures in the ranges lethal to steelhead. The Santa Cruz County Environmental Health Department has collected monthly water quality samples in coastal estuaries throughout the county. These data indicate the San Lorenzo lagoon has significantly elevated levels of nitrogen compared to Aptos and Soquel lagoons (CWC 2003b). Reduced freshwater inflow (due to upstream diversions) coupled with elevated nutrient input from upstream anthropogenic land use practices, act synergistically to create very poor water quality conditions for juvenile steelhead rearing.

When the sandbar to the San Lorenzo River estuary closes during the summer and enough water backs behind the sandbar to form a freshwater lagoon, conditions are set for the creation of optimal steelhead rearing habitat. Even though, for reasons listed above, current conditions

are compromised from historical conditions, the lagoon still provides some important opportunities for juvenile rearing. However, unauthorized and illegal breaching of the sandbar is a frequent occurrence that can drain most of the lagoon and flush steelhead into the ocean prematurely, likely resulting in death of an unknown percentage of the population. Artificial unauthorized sandbar breaching has often occurred multiple times throughout the year since at least the 1980s (Swanson Hydrology and Geomorphology, et al. 2002).

Sediment Transport: Road Density

Many studies have been conducted on sediment-related issues on the San Lorenzo River (Santa Cruz County Planning Department, 1979; D. W. Kelley and Associates 1981, SWRCB 1982; Coats *et al.* 1982; Balance Hydrologics 1998, Santa Cruz Water Resources Program 2001; Swanson Hydrology & Geomorphology 2001) due in part to the loss and degradation of salmonid spawning and rearing habitats across the watershed. Aquatic habitats in the San Lorenzo River have deteriorated considerably from historical conditions (Santa Cruz Planning Department 1979) due to increased rates of sediment input (two to four times background levels (Swanson Hydrology 2001)) into the river. The high rates of sediment input have impaired salmonid spawning, feeding, and rearing habitats by burying spawning gravels, disrupting invertebrate (salmonid food) production, and filling in pools needed by salmonids for thermal and predator refuge. Elevated rates of fine sediment input are considered by many fisheries experts to be the primary limiting factor to salmonid production in the San Lorenzo River (Alley *et al.* 2004).

In 1979, the County of Santa Cruz implemented the San Lorenzo River Watershed Plan (Plan) to assist in setting priorities for erosion control and protection of aquatic habitat in the San Lorenzo River and its tributaries. In addition to adoption of the Plan, the County adopted four other ordinances directly addressing erosion control, sedimentation, and slope stability at the County level.[2] Since the Plan's implementation in 1979, stream conditions have not substantially improved (Balance Hydrologics, Inc. 1998). The most compelling data available are from the Zayante and Bean Creek subwatersheds. In these subwatersheds, the current streambed material is composed of finer bed material than observed in 1979 with fewer clean spawning gravels or cobbles and boulders for summer rearing of young fish. These results suggest actual conditions (as of 1998) in the San Lorenzo River were worse than they were in 1979 for salmonids despite the County's various ordinances designed to protect water quality and riparian habitats.

2 These ordinances are: the Santa Cruz County Erosion Control Ordinance; the Santa Cruz County Riparian Corridor and Wetlands Protection Ordinance; the Santa Cruz County Sensitive Habitat Protection Ordinance; and Grading Regulations.

High levels of instream fine sediment likely impair steelhead spawning and rearing success throughout most of the stream reaches in the watershed. The majority of sediment entering the San Lorenzo River has been identified as originating from private (including roads used for timber harvest plans) and public roads (Balance Hydrologics, Inc. 1998; Swanson Hydrology & Geomorphology 2001)[3]. Based on numerous site visits throughout the County, these conditions appear indicative of the County's road network as a whole (Ambrose, NMFS, personal observations 2000-2013), and it is reasonable to anticipate sediment will continue to be input into the San Lorenzo River at rates above historical levels circa 1850 (pre-European settlement). Additional sources of sediment include major landslides located in areas with highly erosive geology (e.g., the Mount Herman slide located on Bean Creek), channel erosion, rural residential development and associated land use practices, and logging. Continued sediment input will cause salmonid spawning, rearing, and feeding habitats to remain in a degraded condition.

Water Quality: Turbidity or Toxicity

Water is altered from land use practices in the watershed that degrade water quality and steelhead survival, principally through the input of fine sediment which results in increased turbidity, smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of increased sediment input leading to elevated levels of turbidity include roads and road maintenance, residential development, and logging. The variable geology of the watershed lends stream reaches with sandy geology, including Branciforte, Zayante, and Bean Creeks, and downstream reaches of the mainstem river, to be more susceptible to elevated levels of turbidity.

Habitat Complexity: Large Wood & Shelter

According to NHI (2010) California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. This is particularly true in the streams in the Santa Cruz Mountains, which contain little of the low-gradient, wide-valley streams that provide productive rearing habitat for salmonids. The role of large wood in these steeper streams was, in all likelihood, absolutely essential for providing refuge habitat during high flow events in winter because there were fewer opportunities for off-channel habitat refuges (Moyle *et al*., 2008). Data on LWD quantity are lacking for the San Lorenzo, but the paucity of functional instream wood was noted as the primary limiting factor in regard to

[3] According to Balance Hydrologics, Inc. (1998), the strength of the existing County environmental protection ordinances is their ability to guide new permitted development. However, their weaknesses have been in enforcement of violations from unpermitted activities and effecting remedial action to address erosion sources. The cumulative impact of this lack of effective enforcement is a backlog of known violations far exceeding the County's resources to resolve them (Balance Hydrologics, Inc. 1998).

escape cover for rearing juveniles in the watershed (D.W. Alley *et al*. 2004). Rearing habitat quality in most tributaries is limited by the paucity of deep pools with adequate cover. Low abundances of LWD in the San Lorenzo River are likely the result of removal by adjacent landowners and the County of Santa Cruz Department of Public Works. Santa Cruz County funded extensive and effective stream clearance efforts following the 1982 flood but the County has essentially stopped removing LWD since 2009[4]. Unfortunately, unauthorized instream removal of LWD continues on the part of private landowners. The lack of LWD likely is the major contributor to the lower shelter values estimated in the watershed (only seven percent of the stream reaches for which there are data had a shelter value >80 out of a possible rating of 300).

Hydrology: Redd Scour and Hydrology: Baseflow & Passage Flows

Streamflow in the San Lorenzo River is reduced due to water diversions and groundwater pumping as discussed in the section under *Threats: Water Diversions and Impoundments*. The issues related to water use and streamflows are complicated by the number of water users, types of diversions (direct and streamside wells) and the lack of coordination between users.

Increasing residential development and road construction increases the impervious surface in the watershed, thereby increasing the amount of runoff. This, in combination with reduced instream complexity and erosive geology (LWD formed habitats, such as scour pools), increases the likelihood of redd scour during high flow events (D.W. Alley & Associates *et al*. 2004). D.W. Alley & Associates *et al.* (2004) noted that much of the streambed of the San Lorenzo is prone to scour, particularly along the lower mainstem and Zayante, Bean, and Branciforte tributaries. It was not known if scour was widespread or whether it was a significant cause of steelhead egg and alevin mortality.

Landscape Patterns – Urbanization

Landscape patterns are impacted by urbanization that extends along much of the lower mainstem and throughout numerous tributaries in the watershed. Impacts include increased disturbance through sediment and pathogen input, dumping of trash, yard waste, and toxic substances, such as oil and garden chemicals in watercourses, increased levels of pharmaceuticals in the water column, conversion of native riparian vegetation and replacement with detrimental and invasive exotic vegetation, and altered hydrology due to impervious surfaces.

[4] The County of Santa Cruz is applying for authorization through the Corps to remove LWD jams that may threaten infrastructure in specific cases. This is a significant improvement over previous practices when their Department of Public Works removed LWD indiscriminately.

Threats

The highest rated threats and associated impacts to habitats (*e.g.*, stresses) at various lifestages are outlined in San Lorenzo River CAP Results. Recovery strategies will likely focus on ameliorating High and Very High rated threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in the San Lorenzo River CAP Results.

Channel Modification

Channelization is one of the largest impacts of urbanization (Mount 1995) to riverine systems. Most aspects of channelization disrupt the equilibrium of a river: Where a stream is straightened, the stream power will increase, often leading to channel and bank scouring as the stream attempts to reestablish meandering or braided patterns (Mount 1995). The ecological consequences of channelization include: loss, reduction, or alteration of habitat complexity, streamside or bank cover, and pool habitat; and elimination of spawning, rearing, and feeding areas for fish (Brookes 1988). The removal of riparian vegetation associated with channelization directly affects both aquatic and terrestrial communities through increased water temperatures and loss of a local source of energy input (Mount 1995). Channel modification was determined to be a High threat in large part due to the extensive modifications to the tidal prism of the San Lorenzo River estuary and impacts to the watercourse due to residential areas in the upper watershed. These modifications require constant maintenance. This requirement prevents the modified stream reaches from ever fully recovering and achieving properly functioning conditions. Areas of significant modification include the estuary, Branciforte, and lower Carbonera Creeks. Channel maintenance is expected to continue into the future and may actually increase if new policies established by the Corps (post hurricane Katrina) are implemented by the City of Santa Cruz in regard to the existing levees along the San Lorenzo estuary.

Modification has also resulted from the proximity of the extensive road network in the watershed and its adjacency to the mainstem San Lorenzo and most of its tributaries. In areas where houses are close to the bankfull channel, bank hardening often occurs and this hardening prevents or minimizes stream bank erosion which may threaten, or is perceived to threaten, infrastructure. In the San Lorenzo River, these activities have simplified instream habitat complexity and disconnected some stream channels from their floodplains, primarily through stream bank stabilization and channelization measures. These activities are anticipated to continue in the future.

Fire and Fuel Management

Some areas in the San Lorenzo River watershed have high fire hazard rating according to data from CalFire. A major fire, particularly if located in areas with high erosion hazard rating, could result in major increases in fine sediment and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures, which are already above optimal condition along the mainstem, would likely result.

Logging and Wood Harvesting

Timber harvest remains a threat to steelhead habitat in the San Lorenzo River, but at diminished levels compared to historical practices. In the Santa Cruz Mountains, even aged management was replaced long ago by selective harvest. Nonetheless, timber harvest was rated as one of the major sources of sediment contribution in the *Zayante Area Sediment Source Study* (Swanson Hydrology & Geomorphology 2001). For steelhead, timber harvest was listed as a threat for the winter rearing lifestage due to potential increases in turbidity during the wet weather period and the potential for loss of trees that could be recruited into the wetted channel if harvested. Even with application of new California Forest Practice Rules with their limitations on harvest within the riparian zone, these threats are anticipated to continue. Loss of potential future recruitment would remove high water refugia and summer rearing areas in a watershed where LWD is already limiting.

Residential and Commercial Development

The 2010 census estimated the population within the San Lorenzo River watershed at 84,098 individuals; 74 percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009) with significant development located in the riparian zones of the mainstem San Lorenzo and many of its tributaries. The population in the watershed is relatively high compared to many other watersheds in the Santa Cruz Mountain's diversity stratum, and the proximity of residences to stream channels and the City of Santa Cruz to the estuary likely place riparian areas and stream channel at greater risk for future alterations despite numerous policies and regulation adopted by the County of Santa Cruz and City of Santa Cruz designed to protect water quality[5]. Many residences and some communities (parts of Felton) in the watershed are at risk for flooding and efforts to minimize the impacts of flooding will likely include removal of instream habitat features, such as large logs (a practice that still occurs, usually illegally). Additionally, residences located adjacent to stream channels are often at

[5] According to Balance Hydrologics, Inc. (1998), the strength of the existing County environmental protection ordinances is their ability to guide new permitted development. However, their weaknesses have been in enforcement of violations from unpermitted activities and effecting remedial action to address erosion sources. The cumulative impact of this lack of effective enforcement is a backlog of known violations far exceeding the County's resources to resolve them (Balance Hydrologics, Inc. 1998).

increased risk of bank erosion, and efforts to protect existing infrastructure will likely include bank stabilization efforts which would further degrade salmonid habitat.

The County of Santa Cruz (2001) rated the interrelationship of various water quality parameters to sources of impairment. The County determined that urban development and associated runoff from urban areas had a high relationship to various pathogens detected in the watershed. The County also determined septic systems and leaky sewers had a high relationship to both elevated pathogen levels and nitrate levels in the watershed. The San Lorenzo Nitrate Management Plan (SCCHSA 1995) determined that an estimated 84% of the current nitrate load in the river resulted from human activities in the watershed. Of that human influenced nitrate load, 57% was associated septic systems in sandy and non-sandy soils. Impairment of water quality, the aquatic environment, and associated riparian areas is anticipated to continue into the future.

Roads

Road densities are high throughout the watershed and estimated at 5.3 miles of road per square mile of watershed area, and at 6.2 miles per square mile of riparian area. Many of these roads are poorly situated and constructed, and improperly maintained. Roads were determined as the primary sediment source in the watershed, including private, public, and timber harvest roads (Santa Cruz County 2001). The periodic grading and leveling of unsurfaced roads continuously expose erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms when it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the San Lorenzo River and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations. These reoccurring bank failures contribute to ongoing instream sedimentation and often are addressed by bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degraded streambed conditions in the watershed (Balance Hydrologics, Inc. 1998). Other impacts of roads include changes and losses to riparian vegetation and structure that lead to ongoing impacts to water quality. Balance Hydrologics, Inc. (1998) reported that repeated riparian disturbance due to road related issues in Bean Creek was self-perpetuating. Stabilization of banks along road corridors, without re-establishment of riparian vegetation, furthered additional bank instability and increased rates of sediment input.

Severe Weather Patterns

Extreme flood events, such as those in 1955 and 1982, could result in major input of sediment from upslope locations. Much of the watershed is comprised of highly erodible geology which would likely impact spawning and rearing habitats when sediment enters the stream channel.

Changes and improvements in land use practices will likely result in lower sediment yield-rates following future flooding events than were experienced after 1955 and 1982 floods. However, much of the watershed is considered impaired and additional flooding events could slow the rate of recovery of instream habitat conditions.

Due to the heavy overdraft of water resources in the San Lorenzo River, the impacts of a severe drought in conjunction with ongoing overdraft of surface flows and the aquifer could be devastating to all lifestages of steelhead in the watershed, particularly during the summer months. Although the watershed is listed as fully appropriated in the summer, the listing is not adequately enforced for permitted surface water diversions. Additionally, even less oversight exists for ground water pumping in the watershed, and this has a significant impact to baseflow. Current demand for water exceeds the safe yield of local aquifers and a severe drought, particularly if occurring over a period of two or more years, and would likely result in significantly reduced flows throughout the watershed and reduce overall steelhead abundance. A major impact to the San Lorenzo River population would compromise the overall viability of the Santa Cruz Mountains Diversity Stratum steelhead population.

Water Diversion and Impoundment

Depletion and diversion of natural flows have altered natural hydrological cycles and subsequent flows in significant portions of the San Lorenzo River. For example, Alley (1998, 1999, 2000a, 2000b, 2002 and Alley et al. 2004) documented many physical changes to salmonid habitats due to changes in streamflow in the watershed. Reduction of flow negatively affects salmonid habitat due to: loss of usable habitats due to dewatering and blockage; stranding of fish resulting from rapid flow fluctuations; migration delays; entrainment of juveniles into unscreened or poorly screened diversions; and increased lethal and sublethal effects resulting from increased water temperatures (Bergren and Filardo 1993, Chapman and Bjornn 1968). In addition, reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas. Growth of young-of-the-year steelhead in the middle and lower mainstem is strongly dependent upon summer stream flow to provide fast-water feeding conditions that allows fish to become large enough to smolt as yearlings (Alley et al. 2004). The cumulative effect of these impacts to instream habitats is reduced juvenile populations in the action area.

Aquatic conditions in the San Lorenzo River are adversely affected by water diversions, and the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board during the summer months. In addition to the impacts from water management operations to the riverine condition for the summer lifestage, water diversions

reduce freshwater inflow to the estuary and extend the duration necessary for conversion of the impounded lagoon to a mixed freshwater lagoon in summer. Artificial breaching resets the time necessary for conversion to freshwater, and in dry years with repeated breaching, the lagoon remains stratified and is poor habitat for rearing steelhead. The City of Santa Cruz diverts the greatest amount of water from the San Lorenzo River with diversions located at the Felton Diversion Dam, Newell Dam (aka Loch Lomond), and above the estuary at Tait Street. Other large diverters include the San Lorenzo Valley Water District, California American Water Company, and City of Scotts Valley, combined with mid-sized diverters, such as the Lompico Creek Water District and numerous other smaller diversions (> 130) adjacent to the river and its tributaries.

Natural variations of flow in the San Lorenzo River watershed cause wide fluctuations in the amount of fish habitat available from year to year, and these natural fluctuations are exacerbated by ongoing water diversions. During dry years, average available rearing habitat is reduced by more than 50 percent and stream diversions as of 1978 (Santa Cruz County Planning Department, 1979) were estimated to further reduce available rearing habitat during dry years by approximately 20 percent. This conclusion on the impact of diversion was affirmed by D.W. Alley and Associates *et al.* (2004) in a review of historical flow data from the USGS gauge at Big Trees. These data suggest during most months there has been a significant reduction in baseflow over the last 60 years and mean and minimum streamflow trends for October show a 17.2% and 32.1% decrease between 1937 and 1997. The reduction of mean and minimum baseflow conditions in October is likely due to water extraction from both surface diversions and well pumping in addition to a possible reduction in late season rainfall (e.g., April and May) that would carry through the summer into fall. D.W. Alley and Associates *et al.* (2004) predicted that the reduction in flows lead to a reduction in the densities of larger juvenile steelhead (*i.e.,* those that reach smolt size) that ranged from 9% in wet years to 27% in dry years.

The Middle and Lower mainstem of the San Lorenzo (as defined by D.W. Alley and Associates *et al.* (2004)) experiences the biggest impact from upstream diversions since most of the tributaries flow into them. Reaches 1 and 2 (in the Gorge, and below Zayante Creek, respectively) show significant reductions in winter baseflow due to the diversion operation at Felton. The other two areas where baseflows during the summer months may have a significant impact on rearing salmonids are in Boulder Creek and Bean Creek. Groundwater pumping in Scotts Valley[6] and diversions in many of the headwater tributaries to Boulder Creek may also have an impact.

[6] USGS gauge data for Carbonera Creek, located above the extent of anadromy, in the City of Scotts Valley shows a significant reduction in baseflows over the last ten years. This creek once flowed year round and now goes dry during the summer. It is likely that this dewatering is due to groundwater pumping and is possibly exacerbated by an increase in impervious surfaces

Another major source of flow reduction is from groundwater pumping. Areas with significant pumping occur in the Zayante and Bean Creek watersheds by the Scotts Valley Water District and the San Lorenzo Valley Water District (D.W. Alley and Associates *et al.* 2004). Ground water within the Lompico Aquifer in the San Lorenzo Valley is overdrafted by as much as 450% (Haynes, San Lorenzo Valley Water Management Agency, personal communication 2001), and ground water levels have dropped as low as 90 feet below historical levels (Denise Duffy & Associates, Inc. 1999). Baseflows in Bean Creek have been reduced by approximately one cfs during the summer and remaining available baseflows now average two cfs (Ricker, Santa Cruz County, personal communication, 2011).

Of six rearing habitat variables identified by D.W. Alley and Associates *et al.* (2004) in the San Lorenzo River, streamflow rated as the primary or secondary limiting factor for five of the six. Additional water diversions will likely continue into the future due to increasing development in the watershed. Increased development and demand for water will result in further declines in streamflow and fish habitat (D.W. Alley and Associates *et al.* 2004).

Disease Predation and Competition

Disease, predation and competition were rated as a High threat to smolts due to the low abundance of smolts in the watershed and their risk to predation. Impacts to abundance may occur as a result of avian (e.g., gulls and mergansers) and marine mammal predation. This threat is likely increased due to a lack of escape cover (large wood and undercut banks), particularly in the estuarine reach of the lower San Lorenzo River.

Recreational Areas and Activities

Recreational areas and activities were rated as a High threat to smolts and juvenile rearing due to a large number of sites and activities that occur in the watershed. These threats include, but are not limited to, the loss of estuarine habitat for the parking lot that serves an amusement park, the operation of instream summer dams, passage difficulties associated with non-operational summer dams, and inadequately maintained trail networks on public lands.

Limiting Conditions, Lifestages, and Habitats

Threat and conditions analysis within the CAP workbook suggests summer and winter lifestages are likely most limiting steelhead productivity in the San Lorenzo watershed. Water quantity and quality are likely inadequate for properly functioning estuarine conditions. The

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which reduces the rate of aquifer recharge. The reduction in flow from upstream to downstream reaches of Carbonera Creek likely reduces habitat quality and quantity for rearing juveniles.

inadequate quantity is largely a result of direct water diversions that impact rearing opportunities in the estuary during the summer and late fall.

General Recovery Strategy

Restore San Lorenzo Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoration of limiting factors in the estuary will benefit the steelhead production in the entire watershed and the steelhead population in the Santa Cruz Mountains diversity stratum. Restoration should address issues impairing water quality, quantity, breaching, habitat availability, and suitability. Efforts should focus on the ultimate causes of impairment as well as the proximate issues limiting current habitat suitability. A comprehensive watershed-wide program to address sediment input, water quantity, and water quality should be initiated in addition to implementation of immediate measure that address and remediate causes of ongoing habitat degradation. It is likely that the San Lorenzo estuary could be restored to a semblance of its biological potential through a focused and comprehensive effort, particularly if actions are focused on enhancing the estuarine reach.

Minimize Diversions and Diversion Effects

Direct diversions and diversions from near stream wells adversely impact the summer rearing lifestage in the lower watershed and summer and fall rearing in the estuary. The diversions likely impact water circulation and thermal regimes when the estuary bars over which reduces available rearing habitat and places rearing salmonids at greater risk when the sandbar prematurely breaches. Water diversions reduce the quantity of water in the wetted stream channel which increases diurnal temperature fluctuations and reduces available rearing habitat. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions and increased oversight by CDFW to ensure compliance with streambed alteration agreements (California Fish and Game Code section 1600 *et seq.*). Increased oversight leading to increased compliance among water diverters would have the added benefit of addressing not only appropriative diversion but riparian diversions as well.

Due to the heavy extraction of water from the river, site specific studies should be conducted to ensure adequate instream flow targets are established for all life stages. Studies should include determining critical flow levels for stream reaches impacted by both future and current diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedance probability curves to predict late summer flow

conditions according to parameters established by (D.W. Alley & Associates *et al.* 2004) should also be included.

Additional practices to minimize impacts could include development of off-channel storage facilities to divert water during the winter high flow period in exchange for leaving water instream during the summer low flow period. Efforts to coordinate timing of diversions and sharing of water through conjunctive use agreements could also be developed to minimize impacts. Implementation of a watershed-wide HCP and/or integrated watershed or county-wide management plan could be used to pool available resources, focus mitigation measures to the areas of highest priority and greatest benefit, and minimize costs. For additional recommendations, D.W. Alley & Associates *et al.* (2004) describe other efforts for consideration that should also be considered for reducing impacts of water diversions in the watershed. Through the minimization of the quantity of water diverted during critical periods, significant benefits to the salmonid fishery in the San Lorenzo River are highly likely.

Improve Instream Habitat Quality and Quantity

Recovery actions should focus on improving rearing habitat through retention of naturally recruited LWD and through placement of standard log/boulder habitat structures that can effectively increase holding and rearing habitat. D.W. Alley & Associates et al. (2004) noted that considerable improvements to rearing habitat quality could be made if large woody material were left alone in stream channels to scour deeper pools and provide more cover for juvenile salmonids. In stream reaches with little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation.

Unauthorized large wood removal is a significant problem to maintaining instream habitat quality and quantity. Outreach and education of streamside landowners should become a sustained effort to educate local landowners and regulatory agencies regarding the perceived threats and importance of LWD. This is one of the most important priorities designated in this recovery plan. Landowners who continually remove instream wood without proper authorization should be targeted for education and outreach by the County of Santa Cruz, Corps, CDFW, USFWS, CDFW Game Wardens, RWQCB, and NMFS Office of Law Enforcement.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a severe problem throughout the watershed and are particularly problematic in areas with sandy soils, such as Branciforte, Zayante, and Bean creeks. Restoration actions should focus on identifying and prioritizing current sources of sediment in

areas with high habitat value and/or that impact the middle and lower mainstem of the San Lorenzo River. High priority sites (Kings, Two-Bar, Boulder, Bear, Zayante, Bean, and Branciforte Creeks) should receive initial restoration funding.

Address Urban Runoff and Sewer System Operation and Maintenance

Urban runoff management and sewer system upgrades are needed to address water quality degradation from urban and rural areas. Implementation of recommendations in the San Lorenzo River Watershed Management Plan Update (Santa Cruz County 2001) would help improve water quality throughout the watershed and could benefit both public trust resources as well as public health.

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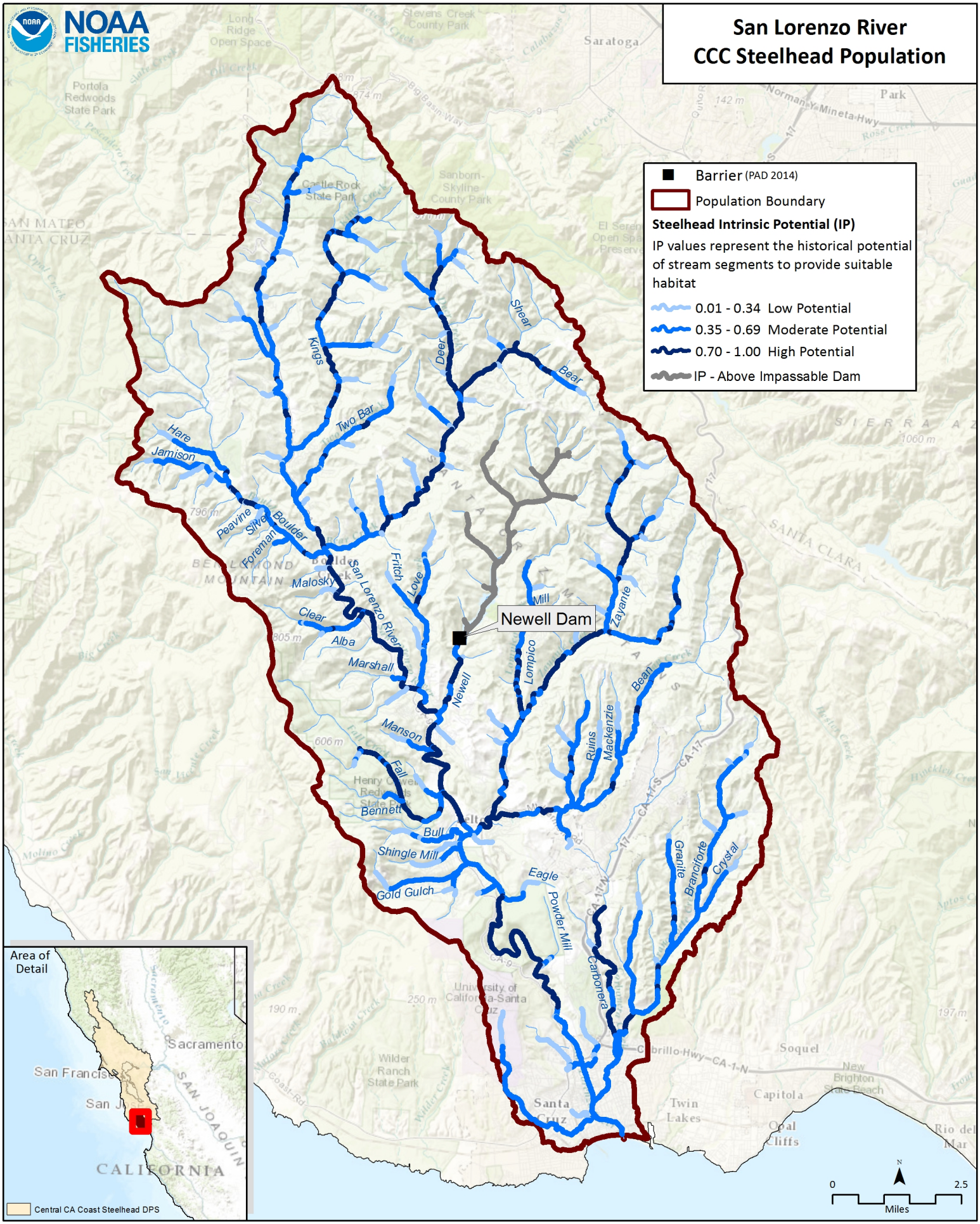
NOAA FISHERIES
San Lorenzo River
CCC Steelhead Population
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Impassable Dam
Newell Dam
Kings
Deer
Shear
Bear
Two Bar
Hare
Jamison
Peavine
Silver
Boulder
Foreman
Malosky
Clear
Alba
Marshall
San Lorenzo River
Fritch
Love
Mill
Zayante
Lompico
Newell
Bean
Ruins
Mackenzie
Manson
Fall
Bennett
Bull
Shingle Mill
Gold Gulch
Eagle
Powder Mill
Carbonera
Granite
Branciforte
Crystal
Area of Detail
Sacramento
San Francisco
San Jose
SAN JOAQUIN
CALIFORNIA
Central CA Coast Steelhead DPS
0
2.5
Miles
N

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (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)	36% streams/ 51% 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)	7% streams 7% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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	83% 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		
			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	?80% Density rating "D" across IP-km	Good

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		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 >75	Poor
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>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)	21% streams/13% 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	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	36% streams/ 64% 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)	36% streams/ 51% 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)	7% streams/ 7% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	83% of IP-km	Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	93% streams 93% IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	21% streams/ 13% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50-74% IP-Km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50-74% IP-Km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.14-0.24 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	36% streams/ 51% IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	83% 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		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	21% streams 13% IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	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)	7% streams/ 7% IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	3.43% of Watershed in Impervious Surfaces	Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.25% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	6% 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	74% of watershed >1 unit/20 acres	Poor
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51 -74%> Historical Species	>75% Intact Historical Species Composition	51 -74%> Historical Species	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	5.3 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	6.2 Miles/Square Mile	Poor

San Lorenzo River CAP Threat Results

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

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat										
SLR-CCCS-1.1.1.1	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).	3	30	CalTrans, CDFW, City of Santa Cruz, Santa Cruz RCD	518	518	518	518	518	3,110	The San Lorenzo estuary was reduced in size following urban development and flood control efforts (by approximately 80% of its historical size), which led to degraded rearing conditions for juvenile salmonids. Urban development from the late 1800s to 1955 filled in the historical tidal prism, which narrowed the river bed (Swanson Hydrology & Geomorphology et al., 2002). Following predictable high flow events that led to flooding in the City of Santa Cruz in 1955, the lower San Lorenzo River was leveed, straightened, and deepened. All the riparian vegetation was removed and the stream banks were hardened with rip rap (Mount 1995). The lagoon and estuary were narrowed considerably by the levee project, and a large island was eliminated (Swanson Hydrology & Geomorphology et al., 2002). These alterations reduced the quantity and quality of available estuarine habitat important for juvenile rearing. Cost based on increasing 10 acres of estuary habitat at a rate of $310,216/acre.
SLR-CCCS-1.1.1.2	Action Step	Estuary	Remove structures impairing or reducing the historical feeding and salt water transition habitat where feasible and benefits to rearing steelhead and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism from modification and/or reduction in the size of the San Lorenzo Park in the City of Santa Cruz.	3	30	CA Coastal Commission, California Coastal Conservancy, CDFW, City of Santa Cruz, Santa Cruz RCD, USACE						TBD	Cost of implementation would be significant. New levees would need be constructed. It is likely that the San Lorenzo estuary could be restored to a semblance of its biological potential through a focused and comprehensive effort. Partial cost accounted for in restore estuarine habitat. Cost to acquire park cannot be determined and will be based on current market value.
SLR-CCCS-1.1.1.3	Action Step	Estuary	Review Water Diversion and Impoundments strategies.	3	20							TBD	
SLR-CCCS-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
SLR-CCCS-1.1.2.1	Action Step	Estuary	Seek State legislation to address liability issues regarding lagoon management.	3	10	City of Santa Cruz, Public						0	Recommendation from the Lower San Lorenzo River and Lagoon Management Plan (2002). Action is considered In-Kind
SLR-CCCS-1.1.2.2	Action Step	Estuary	Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the SLR lagoon.	2	100	CDFW Law Enforcement, City of Santa Cruz, County DA, NMFS OLE						TBD	Financial rewards may act as a deterrent to those involved in the unauthorized breaching of the lagoon. The lagoon has a long history of illegal breaches and to date no one has been successfully prosecuted for this activity. Breaching is believed to result in significant adverse impacts to salmonids rearing in the lagoon. Successful prosecution would likely act as a major deterrent to future individuals who may attempt to breach the sandbar.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-1.1.2.3	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	5	CDFW, City of Santa Cruz	3.00					3	When the sandbar to the San Lorenzo River estuary closes during the summer and water backs behind the sandbar to form a lagoon, conditions are set for the creation of optimal salmonid rearing habitat. Even though, for reasons listed above, current conditions are compromised from historical conditions, the lagoon still provides some important opportunities for juvenile rearing. However, unauthorized and illegal breaching of the sandbar is a frequent occurrence that can drain most of the lagoon and flush salmonids into the ocean prematurely, which likely results in death of an unknown percentage of the population. Artificial sandbar breaching has often occurred multiple times since at least 2000 during the late-summer/early-fall. Cost for signs varies depending on materials and content. Cost for signs estimated at $1,000/sign. Assume a minimum of 3 for lagoon.
SLR-CCCS-1.1.2.4	Action Step	Estuary	Install educational signage along key areas of the estuary to educate the public regarding the importance of estuaries and lagoons for fish and wildlife.	2	5	City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, USACE	5.00					5	Signage should consist of a series of signs in areas with high public use. Signs should explain the importance of estuaries to water quality and endangered species. Cost based on installing a minimum of 5 signs at a rate of $1,000/sign.
SLR-CCCS-1.1.3	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
SLR-CCCS-1.1.3.1	Action Step	Estuary	Enhance streambed aquatic cover and substrate in estuarine and transitional reaches of the SLR.	3	15	CDFW, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, USACE	31.33	31.33	31.33			94	Recommendation from the Lower San Lorenzo River and Lagoon Management Plan (Swanson Hydrology and Geomorphology et al. 2002). This recommendation includes installations of two types of structures: (1) log/boulder structures and (2) cobble and cattail bulrush structures. Cost based on treating 2 acres of estuarine habitat (assume 5% of current estuary extent) at a rate of $46,740/acre.
SLR-CCCS-1.1.3.2	Action Step	Estuary	Enhance riverbank shoreline habitat in transitional and estuarine reaches.	2	10	CDFW, City of Santa Cruz, Santa Cruz RCD, USACE						TBD	Shoreline conditions are degraded in aforementioned reaches due to a lack of vegetation and rooted soil mass in the banks and straight rock rip rap slopes, particularly below Riverside Ave. Recommendations were proposed in the Lower San Lorenzo River and Lagoon Management Plan (Stillwater Sciences et al. 2002): Cost accounted for in enhance streambed aquatic cover.
SLR-CCCS-1.1.3.3	Action Step	Estuary	Install structures designed to enhance scour, increase residual pool depth and shelter for smolt transition and feeding during the spring.	3	20	CDFW, City of Santa Cruz, IWRP, Santa Cruz RCD, USACE						TBD	Costs may vary depending on the total number of structures and necessary engineering. Permitting costs are anticipated to be negligible to likely use of programmatic permits. Cost based on treating 2 acres at a rate of $46,740/acre. This action step should be coordinated with above action steps to reduce cost and redundancy. Cost expected to be higher for greater level of engineering and oversight.
SLR-CCCS-1.1.4	Recovery Action	Estuary	Increase the rate of lagoon formation and/or freshwater conversion										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-1.1.4.1	Action Step	Estuary	Develop and implement longterm solutions that reduce the need for artificial sand bar breaching and address flooding concerns at adjacent properties.	2		City of Santa Cruz, County of Santa Cruz, Santa Cruz Seaside Company						TBD	Ongoing breaching of the San Lorenzo River sand bar is having an adverse and significant impact on the quality of rearing habitat for steelhead in the lagoon. Longterm solutions are needed to meet multiple objectives of reduced flooding, conversion of the lagoon to freshwater, and the need to artificially breach the sand bar. Costs for such solutions will vary depending on the final alternatives and scope.
SLR-CCCS-1.1.4.2	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	5	CDFW, City of Santa Cruz, NMFS, SWRCB						0	Work would entail SWRCB reviewing all existing water diversions; contacting and educating diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to bring into compliance which is reflected in the tentative cost estimate. Action is considered In-Kind
SLR-CCCS-1.1.5	Recovery Action	Estuary	Reduce toxicity and pollutants										
SLR-CCCS-1.1.5.1	Action Step	Estuary	Continue implementation of sanitary sewer upgrades, sewer maintenance and storm drain maintenance practices.	3	100	City of Santa Cruz						0	Maintain a high level of oversight and maintenance for sewer lines which have a higher probability of overflow or leakage. Currently, the City of Santa Cruz has a good sewer line maintenance program, with prompt response to spills, documentation of chronic problem areas, and scheduling of preventative cleaning and maintenance for problem areas. Action is considered In-Kind
SLR-CCCS-1.1.5.2	Action Step	Estuary	Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewers systems and storm drains.	3	5	City of Santa Cruz	15.00					15	Follow up monitoring of storm drain outlets and wet wells should be conducted to verify whether the same storm drains still have high levels and whether there may be other sources of contamination, particularly during dry weather conditions. Monitoring of water level, sand bar condition, tidal affect, flow, temperature, salinity and dissolved oxygen should be done to better characterize overall lagoon water quality. Measurement at various depths in the water column should be done to assess the occurrence of water stratification. Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume a minimum of 3 for estuary habitat. Additional water quality monitoring parameters could increase the cost of this recommendation. Cost does not account for maintenance or data management.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-1.1.5.3	Action Step	Estuary	Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.	3	30	City of Santa Cruz						TBD	Maintain ongoing programs for prompt cleanup of sewage spills and correction of problems with private sewer laterals that cause chronic spills. Water quality data collected in the lagoon reveal degraded water quality parameters that likely adversely affect juvenile steelhead. Swanson Hydrology & Geomorphology et al., (2002) reported very low dissolved oxygen levels and water temperatures in the ranges lethal to steelhead. The Santa Cruz County Environmental Health Department has collected monthly water quality samples in coastal estuaries throughout the county. These data indicate the San Lorenzo lagoon has significantly elevated levels of nitrogen compared to Aptos and Soquel lagoons (CWC and SHG 2003). Elevated nutrient input (from upstream anthropogenic landuse practices), contributes to eutrophication and anoxic events, combined with reduced freshwater inflow (due to upstream diversions) and compromised water circulation patterns due to reduced tidal prism, act synergistically to create very poor water quality conditions for rearing juvenile salmonids.
SLR-CCCS-1.1.5.4	Action Step	Estuary	Develop and implement a strategy to eliminate likely water quality impacts from camping and loitering in floodplain areas.	3	50	City of Santa Cruz						0	This is a complicated effort that will need to involve community leaders, law enforcement, and homeless services providers. Action is considered In-Kind
SLR-CCCS-1.1.5.5	Action Step	Estuary	Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.	3	100	City of Santa Cruz						TBD	Implementation of this practice would include measures such as maintenance of stenciled storm drain warnings, maintaining sweeping programs, encouraging residents and businesses to prevent discharge of anything but storm water into the storm drain system, encouraging pet owners to collect and properly dispose of pet waste, and reduction of non-native waterfowl, such as domestic geese could improve water quality. Cost expected to be absorbed in City/County maintenance initiatives.
SLR-CCCS-1.1.5.6	Action Step	Estuary	Consider requiring evaluation and repair of private sewer laterals, particularly in areas prone to high groundwater conditions.	3	100	City of Santa Cruz, Santa Cruz County						TBD	Consider providing for testing of private laterals and correction at time of sale and/or in areas subject to contamination by subsurface sewage leakage. Although the City of Santa Cruz has upgraded most of its sewer mains, the potential remains for leakage from private laterals in poor condition. Some jurisdictions have implemented programs for inspection or testing and upgrade at time of property transfer. This would reduce dry weather leakage and wet weather infiltration.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-1.1.5.7	Action Step	Estuary	Implement dry weather diversion of storm drain discharge to the sanitary sewer system where other control measures are unsuccessful at reducing bacteria levels.	3	10	City of Santa Cruz						0	Control of sewer leaks and other sources of bacteria contamination requires considerable effort and expense. Even with the best control efforts, storm drains may continue to have elevated bacteria levels. In many cases a simple solution is to divert the dry weather and first flush discharge to the sanitary sewer system. The sewer system and treatment plant will always have substantial excess capacity during the summer and early winter before the wet weather infiltration increases. In some cases flow can be diverted with a weir that allows peak storm flows to continue to discharge to the River. In other cases, the storm drain may need to be physically blocked, with a pump system installed to periodically pump the contents of the backed up storm drain to the sanitary system. The City already does this with the discharge from Neary Lagoon, and has done it several times on a temporary basis in the lower River area. This should again be considered for dealing with storm drains with very high bacteria levels, particularly if efforts are pursued to maintain the freshwater in the lagoon at an elevated level. Action is considered In-Kind
SLR-CCCS-1.1.5.8	Action Step	Estuary	Regularly clean storm drains and removal of accumulations of silt and organic material, particularly before the first storm of the season.	3	100	City of Santa Cruz						0	The City of Santa Cruz has implemented a program of wet well and catch basin cleaning in recent years using their sewer vacuum trucks. Tremendous volumes of material have been removed and transported to the sewage treatment plant and landfill for disposal. Improvement in water quality in discharge water has been reported.
SLR-CCCS-1.1.5.9	Action Step	Estuary	Encourage Seaside Company to develop and implement a litter abatement program to discourage trash and other debris from entering the River from their parking lot area.	3	100	City of Santa Cruz, Private Landowners, Santa Cruz Seaside Company						0	This recommendation originated from the San Lorenzo Urban River Plan (City of Santa Cruz 2003). Action is considered In-Kind
SLR-CCCS-1.1.5.10	Action Step	Estuary	Review Water Quality strategies for additional recommendations.										
SLR-CCCS-1.1.6	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-1.1.6.1	Action Step	Estuary	Evaluate and implement possible structural improvements to maintain water surface elevations during the summer through the late fall in the lagoon.	2	10	CA Coastal Commission, City of Santa Cruz, IWRP, USACE	100.00	100.00				200	Evaluation should include an analysis regarding the feasibility of installing a flume at the mouth of the SLR similar to the nearby flume at the mouth of Soquel Creek and maintained on a yearly basis by the City of Capitola. Cost estimate is for evaluation only, implementation costs cannot be estimated at this time but may exceed $200,000 or more depending on availability of information and concerns from the public and adjacent landowners. Yearly cost of operation by the City of Capitola for Soquel ranges between 70-80K/year. The 1989 San Lorenzo River Enhancement Plan indicated a flume was designed and this existing design may suffice. Cost estimate is based on review of potential new information and regulatory review for the flume. Permitting complication may arise due to concerns regarding newly listed species and issues pertaining to the Corps levees.
SLR-CCCS-1.2	Objective	Estuary	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-1.2.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
SLR-CCCS-1.2.1.1	Action Step	Estuary	Work with the SWRCB to identify and bring into compliance all illegal water diversions in the watershed.	1	10	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB						0	Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in the SLR lagoon by improving water quality and accelerating the rate of freshwater conversion by increasing the volume of water entering the lagoon. Costs cannot be estimated because the location of illegal diversions are not known, quantities of water diverted are unknown, and willingness of those diverting water to come into compliance with State Law is unknown.
SLR-CCCS-1.2.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
SLR-CCCS-1.2.2.1	Action Step	Estuary	Implement patrols by citizens groups, City employees, and law enforcement to ensure the sandbar is not illegally breached.	1	100		0.50	0.50	0.50	0.50	0.50	10	Rough cost estimate for the 100 year period. Close coordination by all parties would likely comprise the majority of the costs. Other methods should also be evaluated such as installation of cameras that provide real time oversight and may result in a reduction in the anticipated cost.
SLR-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFW, Lompico Water District, NOAA RC, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, SWRCB, Trout Unlimited						0	Promoting these types of projects will require a sustained effort to target willing landowners in critical stream reaches. Incentive programs devised by the numerous water agencies in the San Lorenzo River for individual rate payers could result in rapid acceptance of these types of water conservation programs. Action is considered In-Kind
SLR-CCCS-3.1.1.2	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore steelhead habitat.	2	10	CDFW, City of Santa Cruz, City of Scotts Valley, IWRP, NRCS, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, Trout Unlimited						0	Highlighting these issues will likely require the development of MOAs between water users. Conjunctive management of water resources, utilizing surface water and groundwater, in the Scotts Valley/Santa Cruz/Soquel area could meet the current winter demand of the local water purveyors and provide enough surplus water to slowly reverse the overdraft conditions in the major groundwater basins. The benefits of conjunctive use include providing a reliable supplemental supply, replenishment of depleted groundwater basins, and improvements to fisheries habitat. In the long term, if groundwater basins recover sufficiently, additional groundwater could be provided to local residents to provide supplemental supply during dry water years. Action is considered In-Kind
SLR-CCCS-3.1.1.3	Action Step	Hydrology	Implement a comprehensive stream flow evaluation program to determine instream flow needs for salmonids. Focus initial efforts in the middle reaches of the mainstem San Lorenzo River.	2	10	CDFW, City of Santa Cruz, IWRP, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB, Trout Unlimited	37.50	37.50				75	Program can likely leverage off other assessment efforts in the San Lorenzo River watershed. Due to the heavy extraction of water from the river, site specific studies should be conducted to ensure adequate instream flow targets are established for all life stages. Studies should include determining critical flow levels for stream reaches impacted by diversions, both future and current diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions according to parameters established by (Alley et al., 2004) would also be needed. Cost based on stream flow/precipitation model at a rate of $74,195/project.
SLR-CCCS-3.1.1.4	Action Step	Hydrology	Investigate the potential for expansion of the Scott Valley water reclamation system.	3	20	City of Scotts Valley, Santa Cruz County						0	This investigation is occurring as part of the County of Santa Cruz conjunctive use evaluation efforts. Scotts Valley is located above the anadromous portions of the San Lorenzo River watershed. Water savings in Scott Valley should result in increased flow into San Lorenzo River tributaries. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-3.1.1.5	Action Step	Hydrology	Investigate water recharge possibilities in Scotts Valley quarries.	3	20	NMFS, Santa Cruz County, SWRCB, USFWS						0	Aquifer recharge through the quarries should have the stated goal of replenishing overdrawn aquifers and be contingent on not facilitating additional development in the watershed. Careful coordination will be necessary with the USFWS to ensure eventual implementation of this strategy does not conflict with other ESA listed species under their jurisdiction.
SLR-CCCS-3.1.1.6	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFW, NMFS, Public, Santa Cruz County, SWRCB						0	Action is considered In-Kind
SLR-CCCS-3.1.1.7	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	1	100	Private Landowners, Public, SWRCB						0	Cost to promote SWRCB review of existing diversions will likely vary between depending on the cooperation of the diverter. Action is considered In-Kind
SLR-CCCS-3.1.1.8	Action Step	Hydrology	Adopt policies and practices for redevelopment/reconstruction projects to reduce storm water runoff.	2	100	City of Santa Cruz, City of Scotts Valley, NRCS, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD						0	Encourage watershed-friendly practices, such as managing storm water with low-impact features like bioswales and rain gardens, use of previous asphalt and concrete, and rain water harvesting. Action is considered In-Kind
SLR-CCCS-3.1.1.9	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	20	CDFW, IWRP, SWRCB						TBD	Costs will vary widely depending on quantity of water converted to instream use. Cost for water purchase/lease estimate of $155/acre ft./yr. Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed.
SLR-CCCS-3.1.1.10	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD						0	Action is considered In-Kind
SLR-CCCS-3.1.2	Recovery Action	Hydrology	Minimize redd scour										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-3.1.2.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5		774					774	Redd scour is likely a limiting factor in some reaches, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of egg and alevin mortality. Cost based on $119,080/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $192,660 for treating 6.5 miles of high IP. Co-related to habitat complexity.
SLR-CCCS-3.1.3	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
SLR-CCCS-3.1.3.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	10							TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Costs will vary depending on the size of the diversion and participation of diverters.
SLR-CCCS-3.1.3.2	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFW, NMFS, NMFS OLE, Public, SWRCB, Trout Unlimited						0	Action is considered In-Kind
SLR-CCCS-3.1.3.3	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of salmonids and authorized diverters (CDFG 2004).	1	100	CDFW, NMFS, Private Landowners, Public, SWRCB						0	Cost to promote SWRCB review existing diversions will likely vary between depending on the cooperation of the diverter. Action is considered In-Kind
SLR-CCCS-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
SLR-CCCS-5.1.1.1	Action Step	Passage	Improve access of spawning adults and juveniles.	2								TBD	

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-5.1.1.2	Action Step	Passage	Remediate passage barriers in San Lorenzo River tributaries.	2	20	CDFW, City of Santa Cruz, IWRP, NMFS HCD, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						TBD	During drought, known passage impediments in tributaries include: the concrete flood control channel in lower Branciforte, the bedrock chute in Zayante Creek, the residential diversion dam downstream of the second bridge on Newell Creek, high gradient riffles in the Bracken Brae reach and upstream in Boulder Creek, the flashboard dam apron in lower Kings Creek, and several bedrock chutes below the Boy Scout Camp on Kings Creek. Cost estimates will vary significantly and all impediments should be closely evaluated. Passage barriers (particularly natural barriers) should not necessarily be modified if the ultimate cause of the impairment is due to excessive water diversions. The impacts of water diversions should be carefully assessed prior to address any natural barrier.
SLR-CCCS-5.1.1.3	Action Step	Passage	Remediate passage barriers on mainstem San Lorenzo River.	2	20		2,500	2,500	2,500	2,500		10,000	In general, migration barriers are not the most significant limiting factor to steelhead in the San Lorenzo River. However, during drought years (in combination with ongoing water diversions) barriers could significantly reduce habitat accessibility in the watershed. Problematic barriers include: Rincon riffle, Four Rock, the wide natural bedrock chute above Ben Lomond, the bridge abutment below Alba Creek confluence, the bedrock step in Brookdale below Larkspur Bridge, the flashboard dam abutment (especially if wood is jammed in it) below the upper Irwin Way Bridge in the town of Boulder Creek, the flashboard dam abutment above the Kings Creek confluence (if jammed with wood), the apron and the box culvert at the Highway 9 bridge at Waterman Gap. Cost estimates will vary significantly and all impediments should be closely evaluated. Passage barriers (particularly natural barriers) should not necessarily be modified if the ultimate cause of the impairment is due to excessive water diversions. The impacts of water diversions should be carefully assessed prior to address any natural barrier.
SLR-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-6.1.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	10	CDFW, City of Santa Cruz, IWRP, NOAA RC, NRCS, Santa Cruz County, Santa Cruz RCD						0	According to NHI (2010) California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. This is particularly true in the streams in the Santa Cruz Mountains which contain little of the low-gradient, wide-valley streams that provide productive rearing habitat for salmonids. Thus, the role of large wood in these steeper streams was, in all likelihood, absolutely essential for providing refuge habitat during high flow events in winter, because there were fewer opportunities for off-channel habitat refuges (Moyle et al., 2008). An education program should initially be directed at landowners along important stream reaches where large wood removal has been identified as an ongoing concern by the resource agencies and the County of Santa Cruz. The recommendation is based on ongoing efforts throughout the ten year period. Education effort would include workshops, mailings, fliers, signage, and focused presentations. Costs could be somewhat minimized through the use of existing materials already created by the RCD and County. Action is considered In-Kind
SLR-CCCS-6.1.1.2	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	100	California Coastal Conservancy, CDFW, NOAA RC, Private Landowners, Santa Cruz RCD, State Parks, USACE							Cost should be minimal. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-6.1.1.3	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	10	CalFire, CalTrans, CDFW, IWRP, NRCS, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, State Parks, USACE	326.00	326.00				652	Data on LWD quantity are limited for the San Lorenzo but the lack of functional instream wood was noted as the primary limiting factor in regard to escape cover for rearing juveniles in the watershed (Alley et al., 2004). Rearing habitat quality in most tributaries is limited by the paucity of deep pools with adequate cover. Low abundances of LWD in the San Lorenzo River is likely the result of removal by adjacent landowners and the County of Santa Cruz. Cost based on treating 22 miles (assume 1 project/mile in 50% High IP) at a rate of $29,640/mile. SLR has136 miles of IP habitat but it is assumed that many reaches will not be treated due to concerns over impacts to existing infrastructure and flood capacity issues. Costs will be higher if engineered large wood placement approaches are used. Cost to implement ELJ for 22 miles of stream is $2,608,320. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody debris should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the SLR was allowed to stay in place.
SLR-CCCS-6.1.1.4	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid rearing habitats in the San Lorenzo River. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CDFW, Santa Cruz County, Santa Cruz RCD, State Parks						0	Cost savings would be significant. Currently a significant amount of large woody material is removed without proper authorization in the San Lorenzo River. Action is considered In-Kind
SLR-CCCS-6.1.1.5	Action Step	Habitat Complexity	If log jams are modified for fish passage, where applicable and safe to do so retain the LWD for instream enhancement projects that address poor shelter for juveniles and smolts; otherwise consider opportunities to relocate the LWD to use in restoration projects at other locations.	2	100	CDFW, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, State Parks						0	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Action is considered In-Kind
SLR-CCCS-6.1.1.6	Action Step	Habitat Complexity	Encourage the County of Santa Cruz to expand large instream wood structure tracking.	2	10	Santa Cruz County						0	Additional tracking efforts will provide greater certainty to regulatory agencies and land owners in regard to potential threats and benefits posed by instream woody debris.
SLR-CCCS-6.1.1.7	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CalFire, Private Landowners, State Parks	221.00	221.00	221.00	221.00		884	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely or insignificant to downstream reaches. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost for treating 6.6 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,673/acre.
SLR-CCCS-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-6.1.2.1	Action Step	Habitat Complexity	Target restoration actions in the mainstem reach between the upper Rincon Bend and the Tait Street diversion.	2	10	CDFW, City of Santa Cruz, RWQCB, Santa Cruz County, Santa Cruz RCD, State Parks	50.00	50.00				100	This area is low gradient and accessible to adult salmonids during drier water years. Growth potential may be good (although temperatures may be high), it is relatively unconfined with deep pools where steelhead juveniles occur. Enhancement opportunities are high at the heads of some of the deeper pools.
SLR-CCCS-6.2	Objective	Habitat Complexity	Address other natural or manmade factors affecting the species' continued existence										
SLR-CCCS-6.2.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings										
SLR-CCCS-6.2.1.1	Action Step	Habitat Complexity	Fund a watershed coordinator position.	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, CalTrans, CDFW, City of Santa Cruz, City of Scotts Valley, IWRP, Lompico Water District, NMFS, NOAA RC, Private Landowners, Red Tree, Redwood Empire, Roaring Camp Railroad, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks, USFWS	350.00	350.00				700	A watershed coordinator is necessary in the San Lorenzo River watershed due to 1) the large number of small landowners adjacent to important watercourses and 2) multiple water agencies, and governmental jurisdictions that often work in a limited and uncoordinated fashion in regard to restoration activities. A coordinator should be able to work with various stakeholders to facilitate rapid implementation of high priority restoration and habitat enhancement projects. A watershed coordinator should have a thorough understanding of social and environmental constraints and opportunities in the San Lorenzo River. A qualified coordinator will be well versed in various State, County, and Federal permitting requirements and local issues and concerns with the various constituencies.
SLR-CCCS-7.1	Objective	Riparian	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-7.1.1	Recovery Action	Riparian	Improve canopy cover										
SLR-CCCS-7.1.1.1	Action Step	Riparian	Work with PG&E to ensure practices to minimize impacts to riparian areas.	2	10	CDFW, NMFS, PG&E, Private Landowners, RWQCB, Santa Cruz County						0	PG&E trims and removes trees along power line right-of-ways, which may contribute to increased sediment input, temperature increases, and reduced wood input into streams.
SLR-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-8.1.1.1	Action Step	Sediment	Conduct road surveys beginning with inner gorge roads in sandy soils followed by roads in other settings.	3	20	CalFire, California Geological Survey, IWRP, Santa Cruz County, Santa Cruz RCD						TBD	Initial focus should be directed at the lower reaches of Bean, Zayante, Love, and Newell Creeks. County of Santa Cruz has completed road surveys on inner gorge roads. Cost accounted for in other action steps ROADS/RAILROADS.
SLR-CCCS-8.1.1.2	Action Step	Sediment	Implement sediment reduction efforts on tributaries that deliver sediment directly to the Middle River and on Zayante and Branciforte Creeks.	3	20	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						TBD	Cost accounted for in other action steps.
SLR-CCCS-8.1.1.3	Action Step	Sediment	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2								TBD	Cost based on amount and type of conservation measures to promote. Fair market value and landowner participation are major factors to feasibility of alternatives.
SLR-CCCS-8.1.1.4	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	2	100	CalFire, City of Santa Cruz, City of Scotts Valley, County of Santa Cruz						0	Stream reaches with a total of 1.5 to 2 bankfull widths (on both banks) of healthy native riparian vegetation offer the best instream habitat and have the most stable banks (Balance Hydrologics 1998). County of Santa Cruz has established county regulations for buffers for new development projects. Action is considered In-Kind
SLR-CCCS-8.1.2	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
SLR-CCCS-8.1.2.1	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	2	100	CalFire, IWRP, NRCS, Private Landowners, RWQCB, Santa Cruz County, State Parks						TBD	Initial focus should be directed at the middle river and adjacent subwatersheds. Cost accounted for in other action steps.
SLR-CCCS-8.1.2.2	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Lorenzo River.	3	50	California Geological Survey, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD						TBD	Ultimate reasons for bank failure should be identified and addressed. Bank and landslide stabilization should evaluate a full range of options to address instability such as setting back or removing problematic infrastructure (roads, etc). Bioengineering should be the first stabilization method assessed. Bank hardening is not a preferred alternative. Focus initial efforts in Core areas. Cost based on amount of landslide and bank failures to treat. Cost can vary depending on approach taken but estimated at$3,492/acre.
SLR-CCCS-8.1.2.3	Action Step	Sediment	Address sources of sediment contribution originating from the Santa Margarita Sandstone Formation.	2	50	CalFire, CalTrans, City of Scotts Valley, County of Santa Cruz, FEMA, IWRP, Santa Cruz RCD							Watersheds of particular importance in the Santa Margaritia Sandstone Formation include Zayante and Bean Creeks. Santa Cruz County and the City of Scotts Valley should coordinate and standardize erosion control efforts including implementation of standardized BMPs and strengthening of existing erosion control ordinances.
SLR-CCCS-8.1.2.4	Action Step	Sediment	Implement sediment reduction efforts on tributaries that deliver sediment directly to the Middle River and on Zayante and Branciforte Creeks.	2	100	IWRP						TBD	Key river tributaries include Kings, Two-Bar, Boulder, and Bear Creeks. Sediment reduction in these tributaries will have a cumulative benefit to the Middle River which (according to the San Lorenzo River Salmonid Enhancement Plan (2004)) is potentially a very productive reach of river.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-8.1.2.5	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Lorenzo River.	2	100	CDFW, City of Scotts Valley, County of Santa Cruz, FEMA, IWRP, NRCS, RWQCB, USACE						TBD	Extent of bank failures are unknown and therefore costs could not be estimated. Repairs should be completed using bioengineering techniques and material, where appropriate. Habitat enhancement should be incorporated into the engineering design, where appropriate. NMFS (2008) estimated bank stabilization can cost from $284 to $398 per foot of stream bank stabilized depending on distance from access roads.
SLR-CCCS-8.1.2.6	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalTrans, City of Scotts Valley, County of Santa Cruz, RWQCB						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.
SLR-CCCS-8.1.2.7	Action Step	Sediment	Location for long-term sediment spoil sites should be identified and developed.	2	10	CalTrans, City of Scotts Valley, County of Santa Cruz, NRCS, RWQCB						TBD	A significant amount of sediment is removed from inside ditches and road surfaces during winter months due to general erosion and removal of landslides and is temporarily deposited in areas with hydraulic connectivity to watercourses.
SLR-CCCS-10.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-10.1.1	Recovery Action	Water Quality	Improve instream temperature conditions										
SLR-CCCS-10.1.1.1	Action Step	Water Quality	Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.	2	5	City of Santa Cruz, City of Scotts Valley, Private Landowners, Public, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD	5.00					5	Temperature monitoring is relatively inexpensive. A thermograph should be installed in each tributary and in mainstem locations above and below each major confluence. Results should be compiled in one document and submitted to all participants and appropriate regulatory agencies on a yearly basis. Standard presentations should be used. Cost for stream temperature gauge estimated $500/gauge. Assume a minimum of 10. Cost does not account for maintenance or data management.
SLR-CCCS-10.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants.										
SLR-CCCS-10.1.2.1	Action Step	Water Quality	Implement improved wastewater disposal management though the San Lorenzo Wastewater Management Plan.	3	10	RWQCB, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-10.1.2.2	Action Step	Water Quality	Work with stable owners to reduce nitrate discharge by at least 50%	3	20	RWQCB, Santa Cruz County, Santa Cruz RCD						0	Action is considered In-Kind
SLR-CCCS-10.1.2.3	Action Step	Water Quality	Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	50	RWQCB, San Mateo RCD, Santa Cruz County						0	This recommendation should be considered standard practice. Action is considered In-Kind
SLR-CCCS-10.1.2.4	Action Step	Water Quality	Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo River Watershed.	1	100	County of Santa Cruz						0	This is an ongoing program. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-10.1.2.5	Action Step	Water Quality	Implement enhanced technology for at least 50% nitrogen removal for septic systems in sandy soils.	2	10	County of Santa Cruz						0	This is an ongoing program that is part of the counties operations. Action is considered In-Kind
SLR-CCCS-10.1.2.6	Action Step	Water Quality	County of Santa Cruz should continue current waste water management planning efforts in the San Lorenzo River.	2	50	County of Santa Cruz						0	The County's efforts are essential for assessing and directing efforts to address water quality impacts in the watershed. The County should evaluate whether expansion of the program would help to reduce adverse impacts to water quality. Action is considered In-Kind
SLR-CCCS-10.1.2.7	Action Step	Water Quality	Assess impacts of swimming pool cleaning, filling, and discharge into local creeks.	3	3	County of Santa Cruz, RWQCB						0	Dumping of chlorinated water may result in localized impacts to rearing salmonids. If unauthorized discharge is determined to be a problem and concerted education and enforcement effort should follow up in affected watersheds. Action is considered In-Kind
SLR-CCCS-10.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
SLR-CCCS-10.1.3.1	Action Step	Water Quality	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	County of Santa Cruz, RWQCB						0	Cost should be absorbed in new or upgraded network. Action is considered In-Kind
SLR-CCCS-10.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10	CDFW, County of Santa Cruz, NMFS, RWQCB						0	Action is considered In-Kind
SLR-CCCS-10.2	Objective	Water Quality	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-10.2.1	Recovery Action	Water Quality	Reduce toxicity and pollutants										
SLR-CCCS-10.2.1.1	Action Step	Water Quality	Evaluate establishing regulations regarding transport of commercial quantities of toxic chemicals along the Highway 9 corridor.	3	100	CalTrans, County of Santa Cruz						0	Minimizing or prohibiting transport of toxic chemicals would significantly reduce the likelihood of a toxic spill in the watershed. Economic consequences are currently unknown but would entail rerouting and indeterminate amount of traffic along Highway 17 rather than over Highway 9 and Highway 236. Action is considered In-Kind
SLR-CCCS-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										
SLR-CCCS-11.1.1.1	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	2	10		65.50	65.50				131	Cost based on fish/habitat restoration model at a rate of $130,941/project.
SLR-CCCS-11.1.1.2	Action Step	Viability	Monitor population status for response to recovery actions.	2	5								Cost accounted for in Monitoring Chapter.
SLR-CCCS-11.1.1.3	Action Step	Viability	Upgrade the Felton diversion facility to allow assessment of smolt outmigration in addition to ongoing adult monitoring.	2	10	CDFW, City of Santa Cruz, NMFS, NOAA SWFSC	60.00	60.00				120	Cost estimates include necessary upgrades and staff time.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-11.1.1.4	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure DPS-wide consistency.	3	10	CDFW, NMFS PRD, NOAA RC, San Lorenzo Valley Water Agency, Santa Cruz County	375.00	375.00				750	Cost estimate based on current monitoring.
SLR-CCCS-13.1	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						0	Eliminating gabion baskets will result in long-term cost savings due to implementation of longer lasting and better engineered solutions. Action is considered In-Kind
SLR-CCCS-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream, to include cumulative effects of stabilization projects.	2	100	California Geological Survey, CalTrans, CDFW, City of Santa Cruz, FEMA, NRCS, Private Landowners, RWQCB, Santa Cruz County, Santa Cruz RCD						0	Modification has also resulted as a consequence of the proximity of the large road network in the watershed and its adjacency to the mainstem San Lorenzo and many of its tributaries. In areas where houses are close to the bankfull channel, bank hardening often occurs to prevent or minimize streambank erosion which may threaten infrastructure. In the San Lorenzo River, these activities have simplified instream habitat complexity and disconnected some stream channels from their floodplains, primarily through streambank stabilization and channelization measures. These activities are anticipated to continue in the future. This recommendation should be adopted as a standard business practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-13.1.1.3	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	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, RWQCB, Santa Cruz County, Santa Cruz RCD						0	Channelization is one of the largest impacts of urbanization (Mount 1995). The ecological consequences of channelization include: loss, reduction, or alteration of habitat complexity, streamside or bank cover, riparian/estuarine vegetation, and pool habitat; and elimination of spawning, rearing, and feeding areas for fish (Brookes 1988). Channel modification was determined to be a high threat in large part due to the extensive modifications to the tidal prism of the San Lorenzo River estuary and impacts to the watercourse due to residential areas in the upper watershed. These modifications require constant maintenance which prevents the modified stream reaches from ever fully recovering and achieving properly functioning conditions. Areas of significant modification include the estuary, Branciforte, and Carbonera Creeks. Channel maintenance is expected to continue into the future and may actually increase if new policies established by the Corps (post hurricane Katrina) are implemented by the City of Santa Cruz. Action is considered In-Kind
SLR-CCCS-13.1.1.4	Action Step	Channel Modification	Review Estuary, Residential and Commercial Development, and Sediment strategies.	3	20	CDFW, County of Santa Cruz, NMFS						0	Action is considered In-Kind
SLR-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
SLR-CCCS-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methods to minimize habitat alteration effects.	2	100	CalFire, California Geological Survey, CalTrans, CDFW, City of Santa Cruz, FEMA, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						0	Action is considered In-Kind
SLR-CCCS-13.1.3	Recovery Action	Channel Modification	Prevent or minimize impairment to passage and migration										
SLR-CCCS-13.1.3.1	Action Step	Channel Modification	Encourage the City of Santa Cruz to provide adult and smolt passage through the Lower San Lorenzo River and the flood control channel on Branciforte Creek according to recommendations in the Lower San Lorenzo River and Lagoon Management Plan.	2	10	CDFW, City of Santa Cruz, NMFS, NOAA RC, USACE	100					100	The City should immediately install baffles into existing slots in the Branciforte flood control channel as an interim measure. Other, more effective solutions should be evaluated and implemented if they do not significantly impair flood conveyance through the channel.
SLR-CCCS-13.2	Objective	Channel Modification	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-13.2.1	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-13.2.1.1	Action Step	Channel Modification	Encourage the Corps of Engineers to review and modify maintenance requirements on the lower San Lorenzo River to avoid or minimize effects on designated Critical Habitat.	2	5	City of Santa Cruz, NMFS, USACE						0	Increasing shade on the lower San Lorenzo River and upper estuarine reach could cool instream temperatures and provide more suitable rearing habitat conditions in the estuary. The Corps should be encouraged to allow important habitat forming features to remain in place where appropriate and where flood capacity will not be impaired beyond channel capacity. Action is considered In-Kind
SLR-CCCS-13.2.2	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCCS-13.2.2.1	Action Step	Channel Modification	Modify county regulatory and planning processes to minimize reconstruction, expansion, or (in some situations) channel stabilization within the 100-year flood prone zones.	2	100	City of Scotts Valley, FEMA, Santa Cruz County, USACE						0	Santa Cruz County has many policies that, if effectively and consistently implemented, would be effective at protecting watershed processes. Modification of existing policies and/or creation of new policies will likely be controversial and implementation costs may be high. Available information indicates the County lack adequate funding to effectively enforce their current policies. Action is considered In-Kind
SLR-CCCS-14.1	Objective	Disease/ Predation/ Competition	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize adverse alterations to riparian species composition and structure										
SLR-CCCS-14.1.1.1	Action Step	Disease/ Predation/ Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.	3	100	Private Landowners, Santa Cruz County	7.50	7.50	7.50	7.50	7.50	150	This will primarily occur through educational and outreach programs. Cost based on treating 1.9 miles (assume 1 project/mile in 5% high IP with 80 acres/mile) at a rate of $985/acre.
SLR-CCCS-14.1.1.2	Action Step	Disease/ Predation/ Competition	Continue outreach and education to prevent spread of the New Zealand mudsnail from the San Lorenzo River to other adjacent watersheds.	3	10	CDFW, City of Santa Cruz, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County						In kind	This will primarily occur through educational programs.
SLR-CCCS-14.2	Objective	Disease/ Predation/ Competition	Address disease or predation										
SLR-CCCS-14.2.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity										
SLR-CCCS-14.2.1.2	Action Step	Disease/ Predation/ Competition	Evaluate possible impacts of annual planting of Chinook salmon from Central Valley hatcheries into Monterey Bay to steelhead survival and abundance.	2	10	CDFW, NMFS, NOAA SWFSC						TBD	Evaluation should include an analysis of potential increases in predator populations (striped bass, sea birds, pinnipeds) resulting from annual planting and consequences to steelhead survival. cost accounted for in above action step.
SLR-CCCS-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire						0	This recommendation should be considered a standard practice. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Santa Cruz County						0	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated. Action is considered In-Kind
SLR-CCCS-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire						0	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Action is considered In-Kind
SLR-CCCS-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						0	Standard business practice. Action is considered In-Kind
SLR-CCCS-15.1.1.5	Action Step	Fire/Fuel Management	CalFire shall encourage to all non-County firefighters to review the final MS Recovery Plan while providing firefighting assistance in the San Lorenzo River watershed (and all other watersheds in the County) and CalFire shall distribute applicable guidelines for protection of salmon and steelhead and their habitats.	2	100	CalFire, Santa Cruz County						0	Cost of providing the plan is minimal. Action is considered In-Kind
SLR-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
SLR-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts and regulatory agencies with expertise in fisheries issues.	3	20	Big Creek Lumber Co, CalFire						0	Action is considered In-Kind
SLR-CCCS-15.1.2.2	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs when possible and avoid drafting from estuaries or streams occupied by listed salmonids.	3	100	CalFire						0	Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting. Action is considered In-Kind
SLR-CCCS-15.1.2.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be adversely affected by fire fighting actions.	2	100	CalFire						0	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations (e.g., picking up water from areas other than San Lorenzo River lagoon). Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire. Action is considered In-Kind
SLR-CCCS-15.1.2.4	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	3	20	CalFire						0	Action is considered In-Kind
SLR-CCCS-15.1.2.5	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	2	20							0	Action is considered In-Kind
SLR-CCCS-15.1.2.6	Action Step	Fire/Fuel Management	Reassess fire risk every ten years.	3	100	CalFire						0	This is an ongoing program of CalFire and should continue. Additional costs are not anticipated. Action is considered In-Kind
SLR-CCCS-15.1.2.7	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	2	100	CalFire, Santa Cruz County	2.50	2.50	2.50	2.50	2.50	50	Cost estimate for the SLR watershed only.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-15.2	Objective	Fire/Fuel Management	Address the inadequacies of existing regulatory mechanisms										
SLR-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SLR-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate recommendations NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies/districts and CalFire.	2	2	CalFire						0	Action is considered In-Kind
SLR-CCCS-16.1	Objective	Fishing/Collecting	Address the inadequacy or existing regulatory mechanisms										
SLR-CCCS-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity										
SLR-CCCS-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFW to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CDFW						0	If river mouth has been artificially breached without appropriate authorization, prohibitions on offshore fishing should continue until appropriate flows occur. Action is considered In-Kind
SLR-CCCS-16.1.1.2	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFW, City of Santa Cruz, NMFS						0	Action is considered In-Kind
SLR-CCCS-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFW to modify the low flow minimum flow closure in Title 14, Section 8.00(b)(1) of the California Code of Regulations to include San Lorenzo River.	2	5	CDFW, NMFS, Public						0	Low flow closures are needed for the San Lorenzo River and should be based on flow gage information from a local watershed. The gauge at Big Trees is likely the most appropriate measurement location. Action is considered In-Kind
SLR-CCCS-16.1.1.4	Action Step	Fishing/Collecting	Work with California Fish and Game Commission to modify the dates of fishing season to be to at least January 15. Consideration should be given to pushing the entire fishing season back so that the total number of fishing days is not reduced significantly.	2	5	California Fish and Game Commission, NMFS, Public						0	Action is considered In-Kind
SLR-CCCS-16.1.1.5	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along the San Lorenzo River that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	2	10	CDFW, Private Landowners, Santa Cruz County, State Parks						0	Cost accounted for in ESTUARY.
SLR-CCCS-16.1.1.6	Action Step	Fishing/Collecting	Increase oversight on anglers fishing in the San Lorenzo River Gorge to ensure compliance with fishing regulations.	1	100	CDFW, CDFW Law Enforcement, NMFS OLE, Public, State Parks						0	Action is considered In-Kind
SLR-CCCS-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCCS-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CDFW, IWRP, Santa Cruz County, SWRCB						0	Action is considered In-Kind
SLR-CCCS-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-19.1.2.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, CDFW, RPFs, Santa Cruz County						0	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered. Action is considered In-Kind
SLR-CCCS-19.1.2.2	Action Step	Logging	Encourage landowners to implement restoration projects as part of their ongoing practices in priority stream reaches, particularly where large woody debris is found lacking.	2	100	CalFire, CDFW, County of Santa Cruz						0	This is an ongoing effort that should be encourage for every THP in the SLR watershed. Action is considered In-Kind
SLR-CCCS-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Santa Cruz County						0	Cost is expected to be minimal. Action is considered In-Kind
SLR-CCCS-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	This action should be considered a high priority within areas composed of Santa Margarita sandstone. Action is considered In-Kind
SLR-CCCS-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
SLR-CCCS-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-19.1.4.2	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
SLR-CCCS-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc).	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-19.1.5.2	Action Step	Logging	Maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture, rural residential, or other land uses.	1	100	CalFire, CDFW, NMFS, Public, Santa Cruz County						TBD	Cost to acquire land is unknown
SLR-CCCS-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SLR-CCCS-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100							0	This recommendation should be considered standard practice and likely to be less expensive than repairing chronic roads. Action is considered In-Kind
SLR-CCCS-19.1.6.2	Action Step	Logging	Minimize road construction in riparian zones	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	Old roads should not be reopened unless for proper decommissioning purposes. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-19.1.6.3	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	100	CalFire, CDFW, RPFs, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-19.2.1	Recovery Action	Logging	Prevent or minimize impairment to water quality (impaired stream temperature)										
SLR-CCCS-19.2.1.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, CDFW, NMFS, RWQCB, Santa Cruz County						0	Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC DPS) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for steelhead rearing. Action is considered In-Kind
SLR-CCCS-19.2.2	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
SLR-CCCS-19.2.2.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within steelhead areas.	3	20	CalFire, CDFW, Private Landowners, RWQCB						0	Action is considered In-Kind
SLR-CCCS-19.2.2.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of steelhead	3	20	Big Creek Lumber Co., Private Landowners, Red Tree, Redwood Empire						0	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Timber harvest remains a threat to salmonid habitat in the San Lorenzo River, but at diminished levels compared to historical practices. In the Santa Cruz Mountains, even aged management was replaced long ago by selective harvest. Nonetheless, timber harvest was rated as one of the major sources of sediment contribution in the Zayante Area Sediment Source Study (Swanson Hydrology & Geomorphology 2001). Even with application of new California Forest Practice Rules these threats are anticipated to continue. Action is considered In-Kind
SLR-CCCS-19.2.2.3	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in high priority stream reaches where large woody material is deficient.	2	100	CalFire, CDFW, Private Landowners, Santa Cruz County						0	Installing large woody material into streams deficient in large wood should be considered a top restoration priority, particularly high priority subwatersheds. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-19.2.2.4	Action Step	Logging	Erosion control measures and road maintenance should be maintained during the entire period between re-entrys.	2	100	Big Creek Lumber Co., CalFire, CDFW, Private Landowners, Red Tree, Redwood Empire, RPFs, RWQCB						0	Action is considered In-Kind
SLR-CCCS-19.2.2.5	Action Step	Logging	Work with CalFire and the county to review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-21.1	Objective	Recreation	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCCS-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-21.1.1.1	Action Step	Recreation	Develop a Road Sediment Reduction Plan for parklands. Plan should prioritize sites and outline implementation and timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	3	20	Santa Cruz County, Santa Cruz RCD, State Parks						TBD	Cost could be combined with other road assessment priorities in the watershed.
SLR-CCCS-21.1.1.2	Action Step	Recreation	Educate users (including mountain bikers, hikers, ORV users, etc) to help prevent or control erosion and sediment problems along the stream.	3	10	CDFW, City of Santa Cruz, NMFS, NOAA RC, Santa Cruz County, Santa Cruz RCD, State Parks						0	Action is considered In-Kind
SLR-CCCS-21.1.1.3	Action Step	Recreation	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	20	California Geological Survey, City of Santa Cruz, Private Landowners, Public, RWQCB, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks						TBD	Costs cannot be determined until appropriate assessments have been conducted. Costs may vary significantly depending on type of road related problems and whether roads are closed or decommissioned.
SLR-CCCS-21.1.2	Recovery Action	Recreation	Prevent or minimize increased landscape disturbance										
SLR-CCCS-21.1.2.1	Action Step	Recreation	Encourage “managed retreat” (removal and/or modification of problematic infrastructure).	3	100	CDFW, City of Santa Cruz, NOAA RC, Private Landowners, Public, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD						0	Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-21.2	Objective	Recreation	Address inadequacies of existing regulatory mechanisms										
SLR-CCCS-21.2.1	Recovery Action	Recreation	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SLR-CCCS-21.2.1.1	Action Step	Recreation	Ensure roads and landings are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 923.5.	3	10	CalFire, Santa Cruz County, Santa Cruz County Land Trust, State Parks						0	Action is considered In-Kind
SLR-CCCS-21.2.2	Recovery Action	Recreation	Prevent or minimize impairment to passage and migration										
SLR-CCCS-21.2.2.1	Action Step	Recreation	Regulate installation and operation of onstream summer dams so passage and summer rearing habitat is not adversely affected.	2	10	City of Santa Cruz, County of Santa Cruz, NMFS, SWRCB, USACE						0	Action is considered In-Kind
SLR-CCCS-21.2.2.2	Action Step	Recreation	Remove all existing summer dams that create a passage impediment to migrating adults or juveniles.	3	30	CDFW, NMFS PRD, NOAA RC, Private Landowners, Public, Santa Cruz County, USACE	371.00	371.00	371.00	371.00	371.00	2,226	Costs may be high due to sediment deposition behind some dams and subsequent analysis of downstream impacts resulting from dam removal/sediment removal. The total cost is unknown due to the uncertainties regarding the extent of the problems and landowner willingness. Some summer dams on the San Lorenzo River have been permitted by the Corps and CDFW. All future Corps section 7 consultations should consider impacts to IP-km and the consequence of the action to steelhead viability and recovery. Approximately 15 dams and dam abutments are believed to impede salmonid passage under some flow conditions in the San Lorenzo River watershed. Cost based on treating 15 barriers at a rate of $148,380/unit.
SLR-CCCS-21.2.2.3	Action Step	Recreation	Require monitoring of adult/juvenile passage at summer dam passage facilities.	2	100	CDFW, NMFS, Private Landowners						0	The cost of monitoring adult/juvenile passage should be incorporated into each summer dam passage facility. Action is considered In-Kind
SLR-CCCS-21.2.2.4	Action Step	Recreation	Implement the most recent NMFS' Guidelines for Summer Dams for all new summer dams seeking streambed alteration agreement or Corps 404 permit.	3	100	CDFW, NMFS, NMFS OLE, Private Landowners, USACE						0	Cost should be minimal to use existing guidelines when evaluating summer dams. Action is considered In-Kind
SLR-CCCS-22.1	Objective	Residential /Commercial Development	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-22.1.1	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-22.1.1.1	Action Step	Residential /Commercial Development	New development in all historical CCC steelhead watersheds should minimize in storm-water runoff, changes in duration, or magnitude of peak flow.	2	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County, SWRCB						TBD	In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis. Encourage watershed-friendly practices, such as managing storm water with low-impact design features like bioswales and rain gardens (to remove pesticides, petrochemicals, and heavy metals from runoff).
SLR-CCCS-22.1.1.2	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 Santa Cruz, City of Scotts Valley, RWQCB, Santa Cruz County						0	This recommendation should be considered as a higher priority in subbasins with highly erodible soils (e.g., Santa Margarita sandstone). Action is considered In-Kind
SLR-CCCS-22.1.1.3	Action Step	Residential /Commercial Development	Provide incentives for water storage and water retention programs and other conservation devices	2	100	IWRP, NRCS, Santa Cruz County, Santa Cruz RCD						TBD	Cost based on amount of incentives to improve flow conditions. Currently, incentive programs already exist and should be explored and expanded upon.
SLR-CCCS-22.1.2	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-22.1.2.1	Action Step	Residential /Commercial Development	Encourage Santa Cruz County to assess the effectiveness of the Sensitive Habitat Ordinance and the Riparian Corridor Protection Ordinance and implement improved performance measures as necessary.	3	5	Santa Cruz County						0	According to Balance Hydrologics, Inc. (1998), the strength of the existing County environmental protection ordinances is their ability to guide new permitted development. However, their weaknesses have been in enforcement of violations from unpermitted activities and effecting remedial action to address erosion sources. The cumulative impact of this lack of effective enforcement is a backlog of known violations far exceeding the County's resources to resolve them (Balance Hydrologics, Inc. 1998). Action is considered In-Kind
SLR-CCCS-22.1.2.2	Action Step	Residential /Commercial Development	Design new developments to minimize impacts to unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a steelhead watercourse.	2	100	Private Landowners, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-22.1.2.3	Action Step	Residential /Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County						0	Functional buffers provide multiple benefits to water processes. Buffers in residential areas frequently become compromised overtime due to encroachment issues. Action is considered In-Kind
SLR-CCCS-22.1.2.4	Action Step	Residential /Commercial Development	Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100								General recommendation that should be applied to all pre-existing and future landuse activities in the watershed.
SLR-CCCS-22.1.3	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCCS-22.1.3.1	Action Step	Residential /Commercial Development	Design new development to allow streams to meander in historical patterns.	1	100	City of Santa Cruz, City of Scotts Valley, RWQCB, Santa Cruz County						0	Protecting riparian zones and their floodplains or channel migration zones averts the need for bank protection in most situations. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-22.1.3.2	Action Step	Residential /Commercial Development	Encourage Santa Cruz County to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	2	100	FEMA, Private Landowners, Santa Cruz County						0	This recommendation should not be interpreted as a procedure to ignore erosion, but as a long term strategy to address chronic and episodic sediment by ensuring new infrastructure is not placed in high risk areas. Action is considered In-Kind
SLR-CCCS-22.1.3.3	Action Step	Residential /Commercial Development	Evaluate watershed infrastructure at high risk of flooding.	3	10	City of Santa Cruz, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks						0	Most of these structures have likely been identified. Action is considered In-Kind
SLR-CCCS-22.1.3.4	Action Step	Residential /Commercial Development	Encourage establishment of conservation easements on floodplain habitat in key stream reaches.	2	100	Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks						0	Action is considered In-Kind
SLR-CCCS-22.1.3.5	Action Step	Residential /Commercial Development	Continue County of Santa Cruz policy of minimizing floodplain development.	1	100	City of Santa Cruz, City of Scotts Valley, County of Santa Cruz						0	Action is considered In-Kind
SLR-CCCS-22.1.4	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
SLR-CCCS-22.1.4.1	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	City of Santa Cruz, City of Scotts Valley, San Lorenzo Valley Water Agency, Santa Cruz County						0	Outreach to landowners already occurs from many of the municipalities and water districts in the watershed. Action is considered In-Kind
SLR-CCCS-22.1.5	Recovery Action	Residential /Commercial Development	Prevent or minimize increased landscape disturbance										
SLR-CCCS-22.1.5.1	Action Step	Residential /Commercial Development	Continue policies of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County						0	The 2000 census estimated the population within the San Lorenzo River watershed at 84,586 individuals; 74 percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009) with significant development located in the riparian zones of the mainstem San Lorenzo and many of its tributaries. The population in the watershed is relatively high compared to many other watersheds in the Santa Cruz Mountain's diversity stratum and the proximity of residences to stream channels and estuary likely place riparian areas and stream channel at greater risk for future alterations despite numerous policies and regulations from the County of Santa Cruz and City of Santa Cruz designed to protect water quality . This action encourages implementation of many existing policies. Action is considered In-Kind
SLR-CCCS-22.1.5.2	Action Step	Residential /Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	1	100	FEMA, Santa Cruz County, Santa Cruz County Land Trust						0	Important areas include forest lands, and areas with high erosive geology. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-22.1.6	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SLR-CCCS-22.1.6.1	Action Step	Residential /Commercial Development	Address failing septic systems in rural areas of the San Lorenzo watershed.	3	10	Santa Cruz County	2.00	2.00				4	County has been very proactive in attempting to address impacts to water quality in the San Lorenzo River. Cost based on installing a minimum of 5 water quality stations at a rate of $763/site.
SLR-CCCS-22.2	Objective	Residential /Commercial Development	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-22.2.1	Recovery Action	Residential /Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
SLR-CCCS-22.2.1.1	Action Step	Residential /Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	2	5	City of Santa Cruz, City of Scotts Valley, PG&E, Santa Cruz County						0	The weakness of the County of Santa Cruz's existing riparian ordinance stems from exemptions allowed for pre-existing development. The current Riparian Corridor Ordinance requires a buffer width of 50 feet. County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs mainstem. Most of the riparian encroachment in the San Lorenzo watershed occurs in the tributaries. Incentives should be investigated to encourage landowners in key areas to allow establishment of a riparian buffer. Action is considered In-Kind
SLR-CCCS-22.2.1.2	Action Step	Residential /Commercial Development	County of Santa Cruz should develop incentives to adopt riparian ordinance for pre-existing development.	2	100	County of Santa Cruz						0	The weakness of the County of Santa Cruz's existing riparian ordinance stems from exemptions allowed for pre-existing development. County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs mainstem. Most of the riparian encroachment in the San Lorenzo watershed occurs in the tributaries. Action is considered In-Kind
SLR-CCCS-22.2.2	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to water quality (increase turbidity, suspended sediment, and/or toxicity)										
SLR-CCCS-22.2.2.1	Action Step	Residential /Commercial Development	Avoid, or at a minimum minimize the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	3	100	EPA, Public, RWQCB, Santa Cruz County, USACE						0	Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SLR-CCCS-22.2.2.2	Action Step	Residential /Commercial Development	Continue efforts to address failing septic systems in rural areas and other water quality impairments	3	100	RWQCB, Santa Cruz County, USACE						TBD	The County of Santa Cruz has a ongoing program that should be expanded to address high nitrate levels in the San Lorenzo River watershed. The County of Santa Cruz (2001) rated the interrelationship of various water quality parameters to sources of impairment. The County determined that urban development and associated runoff from urban areas had a high relationship to various pathogens detected in the watershed. The County also determined septic systems and leaky sewers had a high relationship to both elevated pathogen levels and nitrate levels in the watershed. The San Lorenzo Nitrate Management Plan (County of Santa Cruz 1995) determined that an estimated 84% of the current nitrate load in the River results from human activities in the watershed. Of that human influenced nitrate load, 57% was associated septic systems in sandy and non-sandy soils. Impairment of water quality, the aquatic environment and associated riparian areas are anticipated to continue into the future. Cost likely accounted as part of identifying failing septic systems through water quality monitoring.
SLR-CCCS-22.2.2.3	Action Step	Residential /Commercial Development	Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo River Watershed.	2	100	RWQCB, Santa Cruz County							
SLR-CCCS-22.2.2.4	Action Step	Residential /Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	2	100	RWQCB, Santa Cruz County, USEPA						0	Action is considered In-Kind
SLR-CCCS-22.2.2.5	Action Step	Residential /Commercial Development	Work with jurisdictional agencies to prohibit transport of highly toxic chemicals on Highway 9 road corridor through the San Lorenzo River watershed.	2	100	CalTrans, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-22.2.3	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to watershed hydrology										
SLR-CCCS-22.2.3.1	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	15	City of Santa Cruz, City of Scotts Valley, Santa Cruz County						TBD	Implementation of this recommendation will help reduce rates of channel incision, increase aquifer recharge, and reduce the likelihood of redd scour. Size, number, and type of detention basins is not determined.
SLR-CCCS-22.2.3.2	Action Step	Residential /Commercial Development	Support the development and implementation of regulations for activities that adversely impact groundwater recharge.	2	10	CDFW, City of Santa Cruz, City of Scotts Valley, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-22.2.4	Recovery Action	Residential /Commercial Development	Prevent or minimize increased landscape disturbance										
SLR-CCCS-22.2.4.1	Action Step	Residential /Commercial Development	Discourage Counties from rezoning forestlands to rural residential.	1	100	Santa Cruz County						0	Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SLR-CCCS-22.2.4.2	Action Step	Residential /Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County						0	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality, increased rates of sedimentation, future consequences of flood fighting to riparian zones and bank hardening, etc. The adverse impacts of extensive rural residential development in the San Lorenzo River watershed is reflected in high rates of sedimentation, illegal water diversions, and cannabis cultivation. Action is considered In-Kind
SLR-CCCS-22.2.5	Recovery Action	Residential /Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCCS-22.2.5.1	Action Step	Residential /Commercial Development	Santa Cruz County 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	20	Santa Cruz County						TBD	Many residences and some communities (parts of Felton) in the watershed are at risk for flooding and efforts to minimize the impacts of flooding will likely include removal of instream habitat features such as wood debris (this is a practice that still occurs, usually illegally). Additionally, residences located adjacent to stream channels are often at increased risk of bank erosion and efforts to protect existing infrastructure will likely include bank stabilization efforts which would further degrade salmonid habitat.
SLR-CCCS-22.2.5.2	Action Step	Residential /Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	Santa Cruz County						0	The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection. Action is considered In-Kind
SLR-CCCS-22.2.5.3	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.	1	100	Public, Santa Cruz County, SWRCB						0	Costs should be minimal and are considered part of SWRCB existing authority and obligation. Action is considered In-Kind
SLR-CCCS-22.2.5.4	Action Step	Residential /Commercial Development	Minimize future urban development in floodplains or off channel habitats	2	50							0	Action is considered In-Kind
SLR-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SLR-CCCS-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalFire, CalTrans, City of Scotts Valley, Santa Cruz County						TBD	Cost of implementation will likely be high due to the large amount of existing infrastructure. This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides. Cost cannot be determined without an assessment of road network and site feasibility.
SLR-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										

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SLR-CCCS-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalTrans, City of Santa Cruz, City of Scotts Valley, NRCS, RWQCB, Santa Cruz County, State Parks, USACE							All new and replacement culverts should be sized to accommodate a 100 year flow event.
SLR-CCCS-23.1.2.2	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	3	10	CalFire, CDFW, City of Santa Cruz, City of Scotts Valley, NOAA RC, Santa Cruz County, Santa Cruz RCD						TBD	Cost to develop a database could vary widely.
SLR-CCCS-23.1.2.3	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	20	AC Alliance, County of Santa Cruz						0	Action is considered In-Kind
SLR-CCCS-23.1.2.4	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.	2	60	CalFire, CalTrans, CDFW, FEMA, Santa Cruz County, Santa Cruz County Department of Public Works, Santa Cruz RCD, State Parks, USACE						0	Action is considered In-Kind
SLR-CCCS-23.1.2.5	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	20	CalTrans, CDFW, City of Santa Cruz, City of Scotts Valley, FishNet 4C, Santa Cruz County, Santa Cruz RCD						0	Similar existing programs could be modified and implemented at minimal cost. Action is considered In-Kind
SLR-CCCS-23.1.2.6	Action Step	Roads/Railroads	Encourage outreach to individual landowners and rural road associations to improve road practices.	3	5	IWRP, Santa Cruz RCD	50.00					50	This recommendation can likely be best addressed through the SCRCD's Rural Road Program.
SLR-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	100	CalFire, CalTrans, City of Scotts Valley, NRCS, Private Landowners, RPFs, Santa Cruz County, Santa Cruz RCD						0	Road densities are high throughout the watershed and are estimated at 5.3 miles of road per square mile of watershed area, and at 6.2 miles per square mile of riparian area. Many of these roads are poorly situated, constructed, and improperly maintained. Roads were determined as the primary sediment source in the watershed, including private, public, and timber harvest roads (County of Santa Cruz 2001). The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Action is considered In-Kind

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.1.3.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	CalFire, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks	377.00	377.00				754	Some road assessment have already been conducted in the watershed. Initial assessment efforts should target Core and Priority 1 sub watersheds. Existing assessments should be used when possible. Cost for road inventory estimated at $957/mile (assume 75% of road network) and for erosion assessment estimated at $12.62/acre (assume 25% of total watershed acres).
SLR-CCCS-23.1.3.3	Action Step	Roads/Railroads	Reduce erosion from mainline timber harvest roads.	2	20	CalFire, CDFW, RWQCB, Santa Cruz County						TBD	The Zayante Area Sediment Study and San Lorenzo River Sediment TMDL both identify timber harvest roads as a major contributor of fine-grained sediment to stream channels. Review and implement additional recommendations in San Lorenzo River Salmonid Enhancement Plan (Alley et al. 2004). Areas of greatest sediment contribution were identified in the SLR sediment TMDL are the Kings, Boulder, Zayante and Bear Creek basins. Erosion control measures should be maintained during the entire period between re-entries.
SLR-CCCS-23.1.3.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	30	CalFire, CalTrans, City of Santa Cruz, City of Scotts Valley, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD	114.00	114.00	114.00	114.00	114.00	684	Initial efforts should focus on roads in Branciforte, Bean, Zayante, Bear, and Kings Creek. Roads in urbanized areas will be very difficult to decommission; roads in more remote areas, particularly those used for timber harvest will likely be much easier to target for decommissioning. Decommission of entire riparian road network in the San Lorenzo River Watershed is infeasible, particularly in urban areas. Cost based on treating a portion of the riparian road network in rural areas, assuming 40% of riparian road network is in rural land. Cost based on decommission 50 miles of riparian road at a rate of $13,680/mile. If roads are upgraded, cost would be $1,197,000.
SLR-CCCS-23.1.3.5	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	20	Private Landowners, Santa Cruz County, Santa Cruz RCD						0	Many road associations are inadequately funded. A road improvement fund for the San Lorenzo River could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity. Action is considered In-Kind
SLR-CCCS-23.1.3.6	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County, Santa Cruz RCD	1,642	1,642	1,642	1,642		6,567	Cost based on treating 25 stream crossings (10% of 258 total) at a rate of $262,669/unit.
SLR-CCCS-23.1.3.7	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Private Landowners, RWQCB, Santa Cruz County						TBD	The County of Santa Cruz spent several years trying to find spoils sites in each watershed, but were unable to locate appropriate properties. Future efforts may require incentives to increase landowner participation.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.1.3.8	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, Santa Cruz County	192.50	192.50	192.50	192.50		770	Roadside berms are common on many private and county roads in Santa Cruz County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails). Cost based on upgrading 32 miles (5% of 641 miles of local, neighborhood, and rural road, city street, unseparated) at a rate of $23,940/mile.
SLR-CCCS-23.1.3.9	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-23.1.3.10	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, CalTrans, Private Landowners, Santa Cruz County						TBD	Costs will vary depending on number of culvert upgrades on a road network and the inefficiency of the current drainage system. Pretreatment systems should be installed as part of new projects or upgraded. A maintenance plan should be part of all pretreatment systems.
SLR-CCCS-23.1.3.11	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. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalFire, CalTrans, City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County, State Parks						TBD	Cost difficult to determine but may result in a long term cost savings. Current economic conditions will likely delay implementation of this recommendation, if adopted.
SLR-CCCS-23.1.3.12	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks							This should be an ongoing program. Existing outreach material can likely be used and tailored to private landowners and agencies with road maintenance staff.
SLR-CCCS-23.1.3.13	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	40	CalFire, RPFs, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-23.1.3.14	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or steelhead watersheds.	3	20	CalFire, CalTrans, City of Santa Cruz, City of Scotts Valley, RWQCB, Santa Cruz County, State Parks	220.00	220.00	220.00	220.00		880	This recommendation will be difficult to implement due to extensive development in the San Lorenzo River watershed. Initial roads targeted will likely be unsurfaced seasonal roads, rather than major paved roads, where ongoing maintenance does not comport with modern standards. Targeted areas should include sub watersheds with high erosion potential (e.g., Santa Margarita sandstone). Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost base on decommissioning 64 miles of road network at a rate of
SLR-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.1.4.1	Action Step	Roads/Railroads	Design new roads to minimize impacts to unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, CalTrans, NRCS, State Parks						0	Action is considered In-Kind
SLR-CCCS-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
SLR-CCCS-23.1.5.1	Action Step	Roads/Railroads	Target low flow crossings in Branciforte Creek for removal.	3	10	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD	211.00	211.00				422	Railcar bridges may result in large cost savings as compared to a seismically engineered bridge structure. Cost based on treating 3 barriers at a rate of $140,563/crossing.
SLR-CCCS-23.1.5.2	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	2	100	CalFire, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, USACE						0	Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001). Action is considered In-Kind
SLR-CCCS-23.1.5.3	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.	2	100	CalFire, CalTrans, Santa Cruz County, USACE						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SLR-CCCS-23.1.5.4	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	CalFire, CalTrans, FEMA, NOAA RC, NRCS, Private Landowners, RPFs, RWQCB, Santa Cruz County, Santa Cruz County Department of Public Works, Santa Cruz RCD, State Parks, USACE						0	Replacement of culverts/bridges and upgrading to NMFS standards will result in increased cost for materials and construction but will likely result in structures that can withstand large storm events better than many existing structures. This recommendation applies to all stream crossings, including those on Class 2-3 streams. Action is considered In-Kind
SLR-CCCS-23.1.5.5	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	10								Cost s accounted for in other actions.
SLR-CCCS-23.1.5.6	Action Step	Roads/Railroads	Replace problematic culverts and low flow crossings in Class 1 streams with bridges or appropriate cost effective designs.	2	50	CalFire, CDFW, County of Santa Cruz, NOAA RC, NRCS, Private Landowners, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD, USACE						TBD	Numerous partial barriers are present in the San Lorenzo River Watershed. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages.
SLR-CCCS-23.1.6	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.1.6.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	10	CalFire, Private Landowners, Santa Cruz County, State Parks	75.00	75.00				150	Cost based on treating 1.9 miles (assume 1 project/mile in 5% high IP with 80 acres/mile) at a rate of $985/acre.
SLR-CCCS-23.1.6.2	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalTrans, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-23.1.7	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SLR-CCCS-23.1.7.1	Action Step	Roads/Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources.	3	20	CalFire, CalTrans, City of Scotts Valley, County of Santa Cruz, NRCS, Roaring Camp Railroad, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD						TBD	
SLR-CCCS-23.1.7.2	Action Step	Roads/Railroads	Prioritize sediment reduction from public and private streamside roads.	1	50	CalFire, CalTrans, City of Scotts Valley, County of Santa Cruz, NRCS, Roaring Camp Railroad, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD						TBD	Costs may vary depending on sediment remediation techniques. Road upgrades for the Russian River were estimated to cost 92K per mile (NMFS 2008). Costs for the SLR are likely similar. Ben Lomond, Zayante, Bean, Bear, Kings, Branciforte, and Middle San Lorenzo Basins should be the first areas prioritized for this effort. Priorities determined from estimate sediment yields in SLR TMDL (2002).
SLR-CCCS-23.1.7.3	Action Step	Roads/Railroads	Prioritize sediment reduction from upland roads.	2	30	CalTrans, County of Santa Cruz, FEMA, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD						TBD	Costs may vary depending on sediment remediation techniques. Road upgrades for the Russian River were estimated to cost 92K per mile (NMFS 2008). Costs for the SLR are likely similar. Ben Lomond, Zayante, Bean, and Middle San Lorenzo Basins should be the first areas prioritized for this effort.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.1.7.4	Action Step	Roads/Railroads	Reduce erosion from timber harvest roads.	2	20	CalFire, CDFW, County of Santa Cruz, RWQCB						TBD	The Zayante Area Sediment Study and San Lorenzo River Sediment TMDL both identify timber harvest roads as a major contributor of fine-grained sediment to stream channels. Review and implement additional recommendations in San Lorenzo River Salmonid Enhancement Plan (March 2004). Areas of greatest sediment contribution were identified in the SLR sediment TMDL are the Kings, Boulder, Zayante and Bear Creek basins.
SLR-CCCS-23.1.7.5	Action Step	Roads/Railroads	Review Strategies for Logging and Sediment for additional recommendations.										
SLR-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SLR-CCCS-23.2.1.1	Action Step	Roads/Railroads	Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	Santa Cruz County						0	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the San Lorenzo River and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degraded streambed conditions in the watershed. Action is considered In-Kind
SLR-CCCS-23.2.1.2	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-23.2.1.3	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	25							0	Action is considered In-Kind
SLR-CCCS-23.2.1.4	Action Step	Roads/Railroads	Educate road associations and informal road maintenance collectives to the benefit of integrating into the Santa Cruz County Service Area process.	2	10	IWRP, NRCS, Santa Cruz County, Santa Cruz RCD						0	Action is considered In-Kind
SLR-CCCS-23.2.1.5	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CalTrans, City of Santa Cruz, City of Scotts Valley, Santa Cruz County, State Parks						TBD	Cost may vary significantly. However, a well designed road management plan should result in overall cost savings.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.2.1.6	Action Step	Roads/Railroads	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.	2	10	Santa Cruz County	1,500	1,500				3,000	Cost is anticipated to be primarily from staffing.
SLR-CCCS-23.2.1.7	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, California Department of Mines and Geology, CalTrans, CDFW, City of Santa Cruz, City of Scotts Valley, County of Santa Cruz, FEMA, NMFS, NOAA RC, NRCS, RWQCB, Santa Cruz RCD						0	Costs should be minimal because this should be adopted as a standard business practice of all agencies. Action is considered In-Kind
SLR-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCCS-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CalTrans, FEMA, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks, USACE						0	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions. Action is considered In-Kind
SLR-CCCS-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SLR-CCCS-23.2.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	100	CalFire, CalTrans, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks						0	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the San Lorenzo River and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degraded streambed conditions in the watershed (Balance Hydrologics, Inc. 1998). Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-23.2.3.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	Private Landowners, Santa Cruz County, State Parks						0	Action is considered In-Kind
SLR-CCCS-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, City of Santa Cruz, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks						0	Action is considered In-Kind
SLR-CCCS-23.2.3.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	25	CalFire, CalTrans, RWQCB, Santa Cruz County						0	Action is considered In-Kind
SLR-CCCS-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SLR-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions.	2	10	CDFW, City of Santa Cruz, Lompico Water District, NMFS, NMFS OLE, Private Landowners, San Lorenzo Valley Water Agency, SWRCB	37.50	37.50				75	Many stream reaches in the San Lorenzo River have water diversions and it is likely that a large number of the downstream reaches experience impacts during the summer months. Due to the heavy overdraft of water resources in the watershed, the impacts of a severe drought in conjunction with ongoing overdraft of surface flows and the aquifer could be devastating to multiple lifestages of salmon in the watershed. Although the watershed is listed as fully appropriated in the summer, the listing is not adequately enforced for permitted surface water diversions. Additionally, even less oversight exists for ground water pumping in the watershed which has a significant impact to baseflow. Current demand for water exceeds the safe yield of local aquifers and a severe drought, particularly if occurring over a period of two or more years, would likely result in significantly reduced flows throughout the watershed reducing overall salmonid abundance. Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months. Cost based on stream flow/precipitation model at a rate of $74,195/project.
SLR-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Ensure all water diversions in the watershed are in compliance with all applicable laws and policies during dry and critically dry water years.	1	5	CDFW, City of Santa Cruz, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB, USACE						0	The SWRCB should conduct periodic sweeps of diversions in the San Lorenzo River to ensure they are in compliance with annual reporting requirements and that annual water usage is accurately reported. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Prohibit filling with water all recreational instream summer dams during drought periods.	3	100	CDFW, NMFS OLE						0	Few recreational dams on the San Lorenzo River are permitted. It is anticipated unpermitted dams may be installed on the River or its tributaries. Action is considered In-Kind
SLR-CCCS-24.1.1.4	Action Step	Severe Weather Patterns	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	20	CDFW, NMFS, NMFS OLE, SWRCB						0	Action is considered In-Kind
SLR-CCCS-24.1.1.5	Action Step	Severe Weather Patterns	Encourage SWRCB to bring diversion dams in Hare Creek into compliance with State law.	3	5	CDFW, NMFS, NMFS OLE, SWRCB						0	Providing information to the SWRCB should be of little expense. Action is considered In-Kind
SLR-CCCS-24.1.1.6	Action Step	Severe Weather Patterns	Encourage Lompico Water District to come into compliance with CDFW streambed alteration requirements.	2	3	CDFW, NMFS, NMFS OLE, Public, SWRCB						0	Cost of informing the Water District of streambed alteration agreements requirements should be minimal. The Lompico Water District has been informed by the regulatory agencies many times in the past regarding concerns over ongoing operations and impacts to listed salmonids. Action is considered In-Kind
SLR-CCCS-24.1.1.7	Action Step	Severe Weather Patterns	Minimize future diversions from sources of cool water input	1	100	CDFW, City of Santa Cruz, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB, USACE						0	Cost of protecting these cool water sources is expected to be minimal. Areas of attention should be placed on protecting cool water inflow from natural springs. Particular focus should be placed on springs in Bean Creek near the Zayante Creek confluence and the lower San Lorenzo River (i.e. Pognip). Action is considered In-Kind
SLR-CCCS-24.2	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
SLR-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										
SLR-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	City of Santa Cruz, FEMA, USACE						0	Action is considered In-Kind
SLR-CCCS-24.2.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	City of Santa Cruz, FEMA, USACE	6.55	6.55	6.55	6.55	6.55	131	Cost based on fish/habitat restoration model at a rate of $130,941/project.
SLR-CCCS-24.2.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	CA Coastal Commission, City of Santa Cruz, FEMA, USACE						0	Improvements will likely be necessary to ensure the persistence of the Santa Cruz Boardwalk. Structural improvement should be designed in order to eliminate manipulation of flow patterns of the river. Action is considered In-Kind
SLR-CCCS-24.2.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SLR-CCCS-24.2.2.1	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	1	20	CDFW, City of Santa Cruz, Lompico Water District, NMFS, NMFS OLE, NRCS, Private Landowners, Public, San Lorenzo Valley Water Agency, Santa Cruz RCD, SWRCB, USFWS						TBD	Costs may be significant and cannot be predicted at this time. Initial focus should include the "Rincon" and "Four Rock" areas in the lower San Lorenzo River. These areas should be evaluated in light of all permitted and unpermitted diversions in the upper and middle reaches of the San Lorenzo River.
SLR-CCCS-24.2.2.2	Action Step	Severe Weather Patterns	Target problematic summer dams in Branciforte Creek for removal.	3	20	CDFW, NOAA RC, Santa Cruz County, Santa Cruz RCD							Costs were estimated for removal of summer dam in cooperation with willing landowners. If dam owners are unwilling to willingly remove these structures, costs may be significant and greater than predicted. Presently, three dams that impair passage are located in Branciforte Creek watershed. Costs accounted for in other actions (see Recreation).
SLR-CCCS-24.2.2.3	Action Step	Severe Weather Patterns	Encourage City of Santa Cruz to adequately size proposed desalination facility to facilitate reduced river diversions during drought periods.	2	10	CDFW, NMFS, NMFS OLE, San Lorenzo Valley Water Agency, Scotts Valley Water District, SWRCB, Water Agencies						0	Pooling of resources with other water agencies in Santa Cruz County could result in significant cost savings. Action is considered In-Kind
SLR-CCCS-24.2.2.4	Action Step	Severe Weather Patterns	Encourage other water users (i.e., San Lorenzo Valley Water Districts, Lompico Water District, Scott Valley Water District, etc.) to investigate feasibility of working with cities of Santa Cruz and Soquel to help fund desalination facility that could provide additional water to upper San Lorenzo Valley water customers during drought conditions.	2	20	CDFW, City of Santa Cruz, County of Santa Cruz, Lompico Water District, NMFS, San Lorenzo Valley Water Agency, Santa Cruz County, Scotts Valley Water District, SWRCB						0	Action is considered In-Kind
SLR-CCCS-24.2.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (impaired stream temperature)										
SLR-CCCS-24.2.3.1	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	25	County of Santa Cruz						0	Action is considered In-Kind
SLR-CCCS-24.2.3.2	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	1	100	CDFW, City of Santa Cruz, City of Scotts Valley, Private Landowners, San Lorenzo Valley Water Agency, SWRCB						TBD	Water temperatures during drought will be directly affected by ongoing surface water diversions in the San Lorenzo River and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost accounted for in implementation of other action steps.
SLR-CCCS-24.2.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-24.2.4.1	Action Step	Severe Weather Patterns	Manage Loch Lomond reservoir to maintain suitable rearing conditions in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	3	5	City of Santa Cruz						0	Action is considered In-Kind
SLR-CCCS-24.2.4.2	Action Step	Severe Weather Patterns	Re-evaluate City of Santa Cruz's water right for Loch Lomond Reservoir to determine whether dam re-operation could result in benefits to salmonids in the watershed.	3	10	CDFW, City of Santa Cruz, NMFS, SWRCB						0	Action is considered In-Kind
SLR-CCCS-24.2.4.3	Action Step	Severe Weather Patterns	Work with CDFW, County of Santa Cruz, municipalities (including all water districts in the San Lorenzo watershed), and knowledgeable biologists to develop emergency rules and adopt implementation agreements that will allow operations to continue and protect critical steelhead lifestages.	3	10	CDFW, Santa Cruz County, SWRCB						0	Costs may include consulting expertise to construct a water budget for the San Lorenzo River. Action is considered In-Kind
SLR-CCCS-24.2.4.4	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	3	10	CDFW Law Enforcement, NMFS OLE						0	Costs are anticipated to be absorbed into ongoing activities. Action is considered In-Kind
SLR-CCCS-24.2.4.5	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead.	3	10	CalFire, CalTrans, CDFW, NMFS, RWQCB, SWRCB						0	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality. Action is considered In-Kind
SLR-CCCS-24.2.4.6	Action Step	Severe Weather Patterns	Evaluate performance of all existing fish ladders on the San Lorenzo River to pass migrating fish during drought and high flow conditions.	2	10	CalTrans, CDFW, San Lorenzo Valley Water Agency, Santa Cruz County						0	Evaluation should include an evaluation of existing maintenance requirements and development of landowner agreements where appropriate. Fish ladders that allow passage over barriers currently exist on several tributaries to the San Lorenzo River, including Fall, Zayante, Lompico, and Love Creeks. These existing fish ladders need to be inventoried and assessed for adequacy of passage, modified if necessary, and continually maintained to assure that they are allowing fish passage under most conditions. The timing of maintenance checks would vary depending on flows during the winter season. Action is considered In-Kind
SLR-CCCS-24.2.5	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCCS-24.2.5.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CalTrans, City of Santa Cruz, City of Scotts Valley, FEMA, Private Landowners, RWQCB, Santa Cruz County, USACE						TBD	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. Cost cannot be determined at this time due to a lack of information regarding where these existing habitats remain in juxtaposition to future development.
SLR-CCCS-24.2.5.2	Action Step	Severe Weather Patterns	Avoid or minimize the effects from flood control projects on salmonid habitat.	1	100	CalTrans, City of Santa Cruz, City of Scotts Valley, NRCS, Private Landowners, Santa Cruz County, USACE						0	Not building flood control projects will incur no expenses. Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-24.2.6	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
SLR-CCCS-24.2.6.1	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in Santa Cruz County.	2	5	CDFW, NMFS, Santa Cruz County						0	Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailored to general Santa Cruz County constraints. Costs may be higher if new guidelines are developed that do not rely on protocols from past studies.
SLR-CCCS-24.2.6.2	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of steelhead in any flood management activity.	3	10	City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County						0	Outreach and education are ongoing, and additional costs are expected to be minimal. Action is considered In-Kind
SLR-CCCS-24.2.6.3	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalTrans, Private Landowners, Santa Cruz County						TBD	Extreme flood events such as those that occurred in 1955 and 1982 could result in major input of sediment from upslope locations. Much of the watershed is comprised of highly erodible geology which would likely impact spawning and rearing habitats when sediment enters the stream channel. Changes and improvements in land use practices will likely result in lower sediment yield-rates following future flooding events than were experienced after 1955 and 1982 floods. However, much of the watershed is considered impaired and additional flooding events could slow the rate of recovery of instream habitat conditions. Cost accounted for in other action steps.
SLR-CCCS-24.2.6.4	Action Step	Severe Weather Patterns	Continue implementation of the County of Santa Cruz's Grading and Erosion Control Ordinances.	2	10	Santa Cruz County, Santa Cruz RCD						0	Action is considered In-Kind
SLR-CCCS-24.2.7	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology										
SLR-CCCS-24.2.7.1	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalTrans, City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County, USACE						0	This action step should be adopted as part of future road actions. Action is considered In-Kind
SLR-CCCS-24.2.8	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity										
SLR-CCCS-24.2.8.1	Action Step	Severe Weather Patterns	Implement fish rescue actions during drought conditions.	3	5	City of Santa Cruz, County of Santa Cruz, Public, San Lorenzo Valley Water Agency	100.00					100	Fish rescue can be used as a tool to engage the public regarding the condition of the fishery in the San Lorenzo River.
SLR-CCCS-25.1	Objective	Water Diversion/ Impoundment	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of water quality conditions for rearing juvenile salmonids.	1	100	City of Santa Cruz, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB						0	Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in the SLR lagoon by improving water quality and accelerating the rate of freshwater conversion by increasing the volume of water entering the lagoon. Costs cannot be estimated because the location of illegal diversions are not known, quantities of water diverted are unknown, and willingness of those diverting water to come into compliance with State Law is unknown. Action is considered In-Kind
SLR-CCCS-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SLR-CCCS-25.1.2.1	Action Step	Water Diversion/ Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	20	City of Santa Cruz, City of Scotts Valley, Lompico Water District, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB	18.75	18.75	18.75	18.75		75	River watershed cause wide fluctuations in the amount of fish habitat available from year to year and these natural fluctuations are exacerbated by ongoing water diversions. During dry years, average available rearing habitat is reduced by more than 50 percent and stream diversions, as of 1978 (Santa Cruz County Planning Department, 1979), were estimated to further reduce available rearing habitat during dry years by approximately 20 percent. This conclusion on the impact of diversion was affirmed by Alley et al. (2004) in a review of historical flow data from the USGS gauge at Big Trees. These data suggest that during most months there has been a significant reduction in baseflow over the last 60 years and mean and minimum streamflow trends for October show a 17.2% and 32.1% decrease between 1937 and 1997. The reduction of mean and minimum baseflow conditions in October is likely due to water extraction from both surface diversions and well pumping in addition to a possible reduction in late season rainfall (e.g. – April and May) that would carry through the summer into fall. Alley et al. (2004) predicted that the reduction in flows lead to a reduction in density of larger juvenile steelhead densities that ranged from 9% in wet years to 27% in dry years. Impacts to steelhead would likely be substantial. Cost based on stream flow/precipitation model at

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-25.1.2.2	Action Step	Water Diversion/ Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential steelhead streams that go dry in some years.	2	10	CDFW, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB						TBD	Depletion and diversion of natural flows have altered natural hydrological cycles, and subsequent flows, in significant portions of the San Lorenzo River. For example, Alley (1998, 1999, 2000, 2001, 2002) documented many physical changes to salmonid habitats due to changes in streamflow in the watershed. Reduction of flows negatively affect salmonid habitat due to: loss of usable habitats due to dewatering and blockage; stranding of fish resulting from rapid flow fluctuations; migration delays; entrainment of juveniles into unscreened or poorly screened diversions; and increased lethal and sublethal effects resulting from increased water temperatures (Berggren and Filardo 1993, Chapman and Bjornn 1969). In addition, reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas. The cumulative effect of these impacts to instream habitats is reduced juvenile populations in the action area.
SLR-CCCS-25.1.2.3	Action Step	Water Diversion/ Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	30	CDFW, City of Santa Cruz, Lompico Water District, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, SWRCB						TBD	Costs may be significant depending on site conditions and number of devices installed
SLR-CCCS-25.1.2.4	Action Step	Water Diversion/ Impoundment	Investigate feasibility of desalination to prevent stream dewatering and ensure a more stable source of water overtime.	3	10	CA Coastal Commission, CDFW, City of Santa Cruz, City of Scotts Valley, NMFS, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB						TBD	Costs may be significant. Desalination is an expensive alternative and should be implemented as an option to facilitate improvement in instream flows and not as an option to facilitate increased development within the watershed. If desalination is chosen as a preferred alternative, the facility should be adequately sized to facilitate significant reduction in water diversion impacts to the San Lorenzo River fishery. A regional facility would provide more benefits than a facility constructed to address the water needs of only one or a few water purveyors. Pooling of resources with other water agencies in Santa Cruz County could result in significant cost savings.
SLR-CCCS-25.1.2.5	Action Step	Water Diversion/ Impoundment	Encourage programs and entrepreneurial efforts by private organizations to purchase easements on water rights for maintenance of adequate surface flows via petition change of use and California Water Code Section 1707.	1	20	CDFW, Private Landowners, Santa Cruz County, SWRCB						0	Action is considered In-Kind
SLR-CCCS-25.1.2.6	Action Step	Water Diversion/ Impoundment	Investigate the potential for expansion of the Scott Valley water reclamation system.	2	15	CDFW, City of Scotts Valley, RWQCB, SWRCB						TBD	Scotts Valley is located above the anadromous portions of the San Lorenzo River watershed (specifically Carbonera Creek). Water savings in Scotts Valley should result in increased flow into San Lorenzo River tributaries.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-25.1.2.7	Action Step	Water Diversion/ Impoundment	Investigate water recharge possibilities in Scotts Valley quarries as a water conservation strategy.	3	20	California Geological Survey, City of Scotts Valley, Santa Cruz County, SWRCB, USFWS						0	Aquifer recharge through the quarries should have the stated goal of replenishing overdrawn aquifers and contingent on not facilitating additional development in the watershed. Careful coordination will be necessary with the USFWS to ensure this strategy does not conflict with other ESA listed species. Action is considered In-Kind
SLR-CCCS-25.1.2.8	Action Step	Water Diversion/ Impoundment	Investigate water supplementation options to prevent stream dewatering and ensure a more stable source of water overtime for domestic and commercial consumption.	2	30	CDFW, NOAA RC, Santa Cruz County, Santa Cruz RCD, SWRCB						TBD	Costs may be significant depending on site conditions and number of devices installed.
SLR-CCCS-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration										
SLR-CCCS-25.1.3.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of migration patterns for listed slamonids in the San Lorenzo River.	2	100	City of Santa Cruz, City of Scotts Valley, Lompico Water District, Private Landowners, San Lorenzo Valley Water Agency, SWRCB						0	Action is considered In-Kind
SLR-CCCS-25.1.3.2	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	5	CDFW, CDFW Law Enforcement, City of Santa Cruz, Lompico Water District, NMFS, San Lorenzo Valley Water Agency, SWRCB	61.00					61	The Lompico Water District should install adequate fish screens on diversion intakes as soon as possible. Cost based on fish screen at a rate of $60,950/screen.
SLR-CCCS-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (impaired stream temperature)										
SLR-CCCS-25.1.4.1	Action Step	Water Diversion/ Impoundment	Work with recovery partners to ensure water diversions do not impair water temperatures.	1	100	City of Santa Cruz, City of Scotts Valley, Lompico Water District, RWQCB, San Lorenzo Valley Water Agency, SWRCB						0	As part of future streambed alteration agreement, CDFW should require installation of temperature thermographs upstream and downstream of the diversion. These results should be reviewed on a yearly basis by the SWRCB and CDFW. Action is considered In-Kind
SLR-CCCS-25.1.4.2	Action Step	Water Diversion/ Impoundment	Work with cities of Santa Cruz and Soquel Water District to increase size of proposed desalination plant.	2	5	CA Coastal Commission, CDFW, City of Santa Cruz, NMFS, NOAA NMS, Soquel Creek Water District, SWRCB						TBD	Cost of working with the City and District will be absorbed into ongoing HCP negotiations. Other alternatives to desalination should also be considered. Cost of expanding plant will result in a significant increase in cost to City Water Dept. but will also result in significant flow improvements to anadromous fish resources.
SLR-CCCS-25.2	Objective	Water Diversion/ Impoundment	Address the inadequacy of existing regulatory mechanisms										
SLR-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Develop new policies and regulations to provide suitable flow conditions for CCC steelhead and coho salmon.	2	20	CDFW, SWRCB						0	Action is considered In-Kind
SLR-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Develop and enforce stream flow bypass requirements for diversions in the San Lorenzo River and its tributaries Zayante, Fall, Bear, Boulder, and Branciforte creeks (CDFG 2004).	1	10	CDFW, NMFS, NMFS OLE, SWRCB						TBD	Cost may vary considerably depending on existing baseflow and existing uses of water being diverted. Aquatic conditions in the San Lorenzo River are adversely affected by water diversions and the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board during the summer months. In addition to the impacts from water management operations to the riverine condition for the summer lifestage, water diversions reduce freshwater inflow to the estuary and extend the duration necessary for conversion to a freshwater lagoon during the summer. The City of Santa Cruz is the single largest diverter with diversions located at the Felton Diversion Dam, Newell Dam, and above the estuary at Tait Street. Other large diverters include the San Lorenzo Valley Water District, and City of Scotts Valley, combined with mid-sized diverters such as the Lompico Creek Water District and numerous other smaller diversions (> 130) adjacent to the river and its tributaries.
SLR-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	1	1	CDFW, SWRCB	100					100	Cost is based on a one year pilot study. The study would evaluate rates of compliance and overall impact of currently permitted diversion to coho salmon and steelhead survival and recovery. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions and increased oversight by CDFW to ensure compliance with streambed alteration agreements (section 1600). Increased oversight by CDFW would have the added benefit of addressing not only appropriative diversion but riparian diversions as well.

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Petition the SWRCB to declare the Santa Margarita aquifer fully appropriated.	2	10	CDFW, NMFS, Santa Cruz County, SWRCB						0	The aquifer is currently over drawn resulting in water volumes in the San Lorenzo River. Areas with significant pumping occur in the Zayante and Bean Creek watersheds by the Scotts Valley Water District and the San Lorenzo Valley Water District (Alley et al., 2004). Ground water within the Lompico Aquifer in the San Lorenzo Valley is overdrafted by as much as 450 percent (Haynes, San Lorenzo Valley Water Management Agency, personal communication 2001) and ground water levels have dropped as low as 90 feet below historical levels (Denise Duffy & Associates, Inc. 1999). Baseflows in Bean Creek have been reduced by approximately one cfs during the summer and remaining available baseflows now average two cfs (Ricker, Santa Cruz County, personal communication, 2011). Action is considered In-Kind
SLR-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	NMFS, SWRCB						0	Action is considered In-Kind
SLR-CCCS-25.2.1.6	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	100	SWRCB						0	The middle and lower mainstem of the San Lorenzo (as defined by Alley et al. 2004) experiences the biggest impact from upstream diversions since most of the tributaries flow into them. Reaches 1 and 2 (in the Gorge, and below Zayante Creek, respectively) show significant reductions in winter baseflow due to the diversion operation at Felton. The other two areas where baseflows during the summer months may have a significant impact on rearing salmonids are in Boulder Creek and Bean Creek. Groundwater pumping in Scotts Valley and diversions in many of the headwater tributaries to Boulder Creek may also have an impact. Other current and future impacts likely result from cannabis production.
SLR-CCCS-25.2.1.7	Action Step	Water Diversion/ Impoundment	Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
SLR-CCCS-25.2.1.8	Action Step	Water Diversion/ Impoundment	Minimize any new or increased summer diversions.	1	100	CDFW, SWRCB						0	Of six rearing habitat variables identified by Alley et al. (2004) in the San Lorenzo River, streamflow rated as the primary or secondary limiting factor for five of the six. Additional water diversions will likely continue into the future due to increasing growth in the watershed. Increased development and demand for water will result in further declines in streamflow and fish habitat (Alley et al. (2004). Action is considered In-Kind

San Lorenzo River, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCCS-25.2.1.9	Action Step	Water Diversion/ Impoundment	Work with the City of Santa Cruz (and other major diverters) to minimize impacts of their diversions.	1	10	CDFW, City of Santa Cruz, NMFS, San Lorenzo Valley Water Agency, SWRCB						0	Currently, the City of Santa Cruz is working on a HCP to address impacts. Action is considered In-Kind
SLR-CCCS-25.2.1.10	Action Step	Water Diversion/ Impoundment	Work with the San Lorenzo Valley Water Agency to evaluate potential impacts to stream flow resulting from surface water diversions and timing of diversions. Encourage the San Lorenzo Valley Water Agency to adopt conservative protocols regarding yearly transition from surface water diversions to groundwater pumping.	2	5	CDFW, NMFS, San Lorenzo Valley Water Agency						0	The San Lorenzo Valley Water District and other major diverters should bring their diversion into ESA compliance and CDFW Code 1600 compliance. Action is considered In-Kind
SLR-CCCS-25.2.1.11	Action Step	Water Diversion/ Impoundment	Encourage Lompico Water District to come into compliance with CDFW streambed alteration requirements.	2	10							0	The Lompico Water District has been informed by the regulatory agencies many times in the past regarding concerns over ongoing operations and impacts to listed salmonids. Action is considered In-Kind
SLR-CCCS-25.2.1.12	Action Step	Water Diversion/ Impoundment	Identify source of dewatering in Carbonera Creek near the City of Scotts Valley.	2	10	CDFW, CDFW Law Enforcement, City of Scotts Valley, NMFS, NMFS OLE, SWRCB						0	Upper Carbonera Creek now has major dry back section during the summer. Diversions from nearby wells are suspected. Action is considered In-Kind
SLR-CCCS-25.2.1.13	Action Step	Water Diversion/ Impoundment	Encourage County of Santa Cruz and municipalities continue oversight when issuing building permits in regards to potential adverse impacts to instream flows.	2	100	CDFW, City of Santa Cruz, City of Scotts Valley, Santa Cruz County, SWRCB						0	The County of Santa Cruz currently evaluates potential impacts resulting from new development projects to instream flow. New developments that are determined to result in impacts to instream flow should not be permitted. If impacts are inevitable, fees associated with an offset program should be increased and directed towards water conservation and augmentation efforts in the impacted watershed. Action is considered In-Kind
SLR-CCCS-25.2.1.14	Action Step	Water Diversion/ Impoundment	Work with the County of Santa Cruz to develop and implement a comprehensive water plan to address aquifer overdraft and conjunctive water use for the entire San Lorenzo River.	1	20	CDFW, City of Santa Cruz, City of Scotts Valley, County of Santa Cruz, IWRP, NMFS, San Lorenzo Valley Water Agency						0	Initial efforts are underway and no additional costs to augment this effort are anticipated. Integration with the City of Santa Cruz HCP could yield additional benefits. Action is considered In-Kind

Scott(s) Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 700 adults
- Current Intrinsic Potential: 16.4 IP-km

Steelhead Abundance and Distribution

Scott(s) Creek is a small coastal watershed draining approximately 28 square miles in northern Santa Cruz County. Steelhead can access approximately 14 miles of stream between the estuary and natural upstream barriers on the mainstem and three main tributaries (Little, Big, and Mill Creeks). The small estuary at the bottom of the watershed becomes a freshwater lagoon during the summer and fall when a sandbar builds up at the creek mouth. Juvenile steelhead rear in the lagoon/estuary, as well as the mainstem and tributaries (Bond 2006, Hayes et al. 2008). Stream width varies from approximately 40 meters in the closed estuary to about 10 meters on the mainstem to less than 1 meter in the upper tributaries (Hayes *et al*. 2008). Spawning occurs in the upper portions of the mainstem, Little Creek, Big Creek, Mill Creek, and Bettencourt Gulch (Becker and Reining 2008). Researchers speculate that steelhead spawning occurs occasionally in Quesaria Creek (Sean Hayes, NMFS, personal communication, as cited in Becker and Reining 2008), although the stream is usually dry in late summer.

Smith (2013) has conducted juvenile steelhead surveys in Scott(s) Creek for 22 consecutive years. Overall, YOY steelhead density on Scott(s) Creek in 2013 (28 per 100 feet) declined from the 2010 and 2011 (41 and 45 per 100 feet respectively) and were more similar to the drought years of 2008 and 2009 (20-24 per 100 feet). The 2013 density was less than half of the 1998-2012 mean (48 per 100 feet), and densities declined especially low at the five sites downstream of the confluence with Big Creek. In 2013, yearling abundance (6.2 per 100 feet) was below average.

The estimated adult steelhead escapement in Scott(s) Creek in 2004 through 2010 was 440, 313, 219, 249, 293, 126, and 109, respectively (Sean Hayes, unpublished data). In those years, the annual proportion of returning adult steelhead that was wild ranged from approximately 31 percent to 81 percent (Sean Hayes, unpublished data). During the winter of 2011-12, CDFW conducted steelhead redd surveys in approximately 2.3 kilometers in Scott(s) Creek and approximately 2.3 kilometers in Big Creek (Jankovitz 2012). A total of 27 steelhead redds and 12 adult steelhead were observed and redd densities were 11.4 redds per kilometer in Scott(s) Creek and 0.44 per kilometer in Big Creek. During the winter of 2012-13, CDFW surveyed two

reaches on the mainstem of Scott(s) Creek totaling 3.62 kilometers which contained 27 redds and 5 adult steelhead (Jankovitz 2013). Overall redd density was 7.45 redds per kilometer.

History of Land Use

Water has been diverted from Scott(s) Creek for agricultural use for over 60 years (Snider *et al*. 1995). Logging in the Scott(s) Creek watershed began in the late 1800s. This early logging was limited since there were no railroads in the area at the time. Much of the early skidding of logs was done by oxen. Following the 1906 San Francisco earthquake, logging was conducted on a much larger scale (Scotts Creek Watershed Council 2000).

Starting in 1907, the San Vicente Lumber Company constructed a railroad up Little Creek and over into the upper reaches of Big Creek and into Deadman's Gulch. These logging operations continued until around 1920; the logging technique was clear cutting with steam donkeys used for cable yarding (Scotts Creek Watershed Council 2000).

The next large scale round of logging in Scott(s) Creek took place in the late 1940s and continued to move around to various locations throughout the watershed until the 1960s. This logging was largely tractor skidding with extensive skid road construction (Scotts Creek Watershed Council 2000). The early logging, which concluded in the 1930s, resulted in the harvesting of approximately 30 percent of the Scott(s) Creek watershed. During the logging from the 1940s to the 1960s, an additional nine percent was logged. The total logging prior to the enactment of the Forest Practices Act in 1974 was 39 percent of the watershed. The logging that has taken place since that time has harvested an additional 17 percent of the watershed (Scotts Creek Watershed Council 2000).

Current Resources and Land Management

A small California Department of Fish and Wildlife (CDFW) cooperative hatchery has been operated by the non-profit Monterey Bay Salmon and Trout Project on the Big Creek tributary since 1982, spawning a small number of steelhead (and coho salmon) each spring that are at least one generation removed from the hatchery (Bond 2006).

Principal land uses in the watershed include agriculture and timber, rural residential use and recreation (County of Santa Cruz Environmental Health Services 2011). Seventy percent of the watershed is coniferous forest, with the remaining 30 percent of the watershed either shrubland, grassland, or montane/riparian hardwood forest. Approximately 95 percent of the watershed is in private ownership; the remaining five percent is state and military owned land (National Marine Fisheries Service 2010). Approximately 64 percent of the watershed is owned by four

different landowners (Scotts Creek Watershed Council 2004). Within the past 10 years, about six percent of the watershed has been under timber harvest plans. In 2009, over 7,000 acres of the watershed burned during the Lockheed fire (National Marine Fisheries Service 2010). Recent logging activity has been centered in the upper Scott, Little and Archibald Creek drainages (Scotts Creek Watershed Council 2000).

Salmonid Viability and Watershed Conditions

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

Current Conditions

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

Population and Habitat Conditions

Estuary: Quality & Extent

Estuary/lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond *et al*. 2008). The Scott(s) Creek estuary was reduced in size following European arrival and is currently believed to be a major limiting factor for smolts and, to a lesser extent, summer rearing juveniles. The upper estuary was converted for agricultural purposes, and much of the historical tidal prism was lost due to significant channelization for the construction of the Highway 1 Bridge in the early 1940s. The straightened channel eliminated the natural meander and adjacent marshes areas that existed on the north side of the estuary. The meanders and backwater marshes likely contained areas with residual depth during periods when the sandbar was open which were used by smolts in spring for saltwater acclimation and feeding before going to the ocean. Under current conditions in most years, the straightened estuary essentially drains when the sand bar is open leaving little transitional or feeding habitat for smolts. This impaired condition is likely limiting the size of the steelhead population in Scott Creek. Nonetheless, despite the significant adverse consequences from past channelization, the estuary

remains a productive environment in the Santa Cruz Mountains Diversity Stratum, particularly when compared to estuaries located in watersheds with extensive nearby urban infrastructure.

Of particular note is the unique distinction for lower Scott Creek when in 1915 it was declared a fish sanctuary by the California Legislature (Taft 1934). Scott Creek was defined as its own special district by the California Fish and Game Commission (District fourteen), which established strong fishing prohibitions. According to the Commission, "Fish and game district fourteen shall consist of and include the waters of Scotts creek, in Santa Cruz county, between its mouth and the mouth of Mill creek." Penalties were strong, as indicated by the Commission's language:

> (a) Every person who ... in fish and game district number fourteen, at any time takes, catches, or kills, any kind of fish is guilty of a misdemeanor; (b) It shall be lawful to use dip nets for the purpose of taking fish other than game fish to be used as bait only, in any fish and game district, except fish and game district fourteen; and (c) It shall be lawful to use troll lines or hand lines in any fish and game district excepting fish and game district fourteen (State of California 1925).

Unlike sanctuaries established for other fauna, freshwater fish sanctuaries are very rare in the United States[1]. For reasons not entirely clear, the Legislature repealed (Senate Bill 192) the sanctuary status of District fourteen in April, 1943. Possible reasons for repealing the sanctuary status may include the straightening of the channel for the Highway 1 Bridge or possible pressure from local fishers.

Habitat Complexity: Large Wood & Shelter

According to NHI (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. This is particularly true in the streams in the Santa Cruz Mountains, which contain little of the low-gradient, wide-valley streams that provide productive rearing habitat for salmonids. Thus, the role of large wood in these steeper streams was, in all likelihood, absolutely essential for providing refuge habitat during high flow events in winter, because there were fewer opportunities for off-channel habitat refuges (Moyle *et al*. 2008). Therefore, LWD is an even more critical habitat element than in more northern streams to form pools or areas of refuge from high flows. Although no instream large wood data are available, it is apparent that instream wood is scarce

[1] "President Benjamin Harrison on Christmas Eve 1892 created a salmon refuge on Alaska's Afognak Island and Uganik River. It was the only (Federal) preserve ever established in the United States outside of the national park system. However, the original fishing restrictions were abolished with the passage of the White Act in 1924 and the reserve lost Federal protection in 1959." (Excerpted *from* Montgomery 2003).

in Scott(s) Creek, and when wood enters the channel, it is frequently cut into small pieces[2] (Ambrose, personal observation 2000-2011). These practices adversely affect the summer and winter rearing lifestages. Low LWD abundance in Scott(s) Creek is likely the result of past logging practices that removed trees from riparian areas, followed by Santa Cruz County funded stream clearance efforts following the 1982 flood. Santa Cruz County has essentially stopped removing LWD since 2009, but unauthorized instream removal and modification of LWD continue from private landowners. Low instream LWD volume is likely the major contributor to the lower shelter values estimated in the watershed; only 20 percent of stream reaches had a shelter value >80, which constituted less than three percent of available IP.

Other Stresses

Excessive instream sediment has compromised spawning and rearing habitat within the Scott(s) Creek watershed. Pool filling appears to be occurring from erosion from upslope sources. Sources that contributed to the altered sediment transport include roads, past fires, agriculture, and logging. Substrate conditions (abundant coarse granitic sand) and spawning habitat are poor and regularly subject to redd scour in wet years in Big Creek and Scott Creek downstream of Big Creek (Smith 2013); these habitats are frequently undersaturated with steelhead fry and have low fall juvenile steelhead densities, despite relatively high summer stream flow produced from the granitic geology. The watershed upstream of Big Creek has naturally very low summer stream flows due to the dominance by mudstone geology (Smith 2013). Summer stream flow in Mill Creek is constrained by the lack of bypass flows at the reservoir on upper Mill Creek.

Redd scour is likely a limiting factor in some reaches of Scott(s) Creek, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer sized (sandy) and naturally lighter sediments (low specific gravity) that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels (Smith 2013). Reduced instream habitat complexity (*i.e*, a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of steelhead egg and alevin mortality.

Threats

The following discussion focuses on those threats that were rated as High or Very High. Recovery strategies will likely focus on ameliorating High rated threats; however, some

[2] Wood cut into small pieces is more likely to mobilize during high flow events and encourage jams and damage to downstream infrastructure.

strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Scott Creek CAP Results.

Fire, Fuel Management, and Fire Suppression

Some areas in the Scott(s) Creek watershed have a high fire hazard rating according to CalFire data. A major fire occurred in the watershed in 2009 and burned extensive forested portions of the watershed. While fuel loading has been reduced following the 2009 fire, future wildfires are probable. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the altered rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures would likely result.

Roads

Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile of watershed area, and at 4.0 miles per square mile of riparian area. Many of these roads are poorly situated, unpaved, and are sources of chronic sediment input. Paved and unpaved roads parallel many of the waterways within Scott(s) Creek and impinge upon channel migration. Some roads in the watershed are used for timber harvest and receive heightened levels of maintenance and review, at least for a short time (currently three years) following completion of a timber harvest plan.

Channel Modification

Stream channels in Scott(s) Creek have been modified through three methods: (1) channel straightening and levee construction, (2) removal of instream structure, and (3) bank stabilization to protect roads. Levees were constructed on the lower Scott Creek floodplain to facilitate farming and to concentrate and direct flows under the Highway 1 Bridge in the estuary. These levees receive little, if any maintenance, and in the riverine reach the levees are well vegetated. Nonetheless, the levees continue to function and likely reduce the total amount of rearing habitat in the estuary and disconnect stream flood flow from its floodplain.

Wood modification and removal was a practice that occurred in the recent past. As sediment moves downstream through a watershed, it is often held in place by instream structures, such as wood. Stored sediment can provide important spawning and rearing habitats for salmonids. When LWD is removed, the sediment typically washes downstream, and in many situations, the stream channel will downcut and can become entrenched. A consequence of channel entrenchment is that the stream banks become overly steepened and increasingly unstable. In areas where highly entrenched channels occur adjacent to structures, roads, and similar

improvements, landowners often attempt to stabilize the stream banks to protect their property. Their attempts, however, result in a net degradation of riparian and instream habitats. Some stream reaches in Scott(s) Creek appear entrenched, and it is anticipated that future bank hardening, particularly along reaches with adjacent roads, will occur in some areas of the watershed.

Severe Weather Patterns

Extreme flood events such as those that occurred in 1955 and 1982 could result in major sediment input from upslope locations. Changes and improvements to land-use practices will likely result in lower sediment yields following future flooding events than likely experienced after the 1955 and 1982 floods. However, additional flooding events could slow the rate of recovery for instream habitat conditions.

Impacts of a severe drought in conjunction with ongoing water diversion could affect all lifestages of steelhead in the watershed. A severe drought could reduce total water yield and delay or limit adult steelhead migration to spawning areas; reduce juvenile rearing habitat; and expose winter rearing, summer rearing, and smolt steelhead to increased predation.

Logging and Wood Harvesting

Logging was identified as a potential future threat to summer rearing juveniles due to the potential for timber management to reduce future recruitment of riparian trees into stream channels and increase instream temperatures. California Forest Practice Rules require retention of riparian trees adjacent to Class 1 fish bearing streams, which will ameliorate the impacts of reduced LWD and overstory canopy reduction, but this is not equivalent to a no-harvest buffer. Santa Cruz County rules do not allow even aged management anywhere in the County. Despite these restrictions, it is likely that due to the degraded status of instream habitat complexity and the fact that some stream reaches are near thermal thresholds for instream temperatures, future timber management may reduce or delay the rate of future recruitment by harvesting trees potentially recruited into stream channels. This impact could be partially offest if a large wood augmentation program were included into harvest plans. An augmentation program would need to evaluate limiting factors, including riparian canopy cover and instream temperature regimes. Augmentation could include using large wood (preferably redwood) from offsite sources. The regulatory agencies participating in the Wood for Salmon working group are working to identify mechanisms to streamline this process.

Limiting Conditions, Lifestages, and Habitats

Threat and condition analysis within the CAP workbook indicates all lifestages are impaired in the Scott(s) Creek watershed, with summer rearing being the most stressed. Water quantity is likely the most significant limiting habitat attribute, and residential development and the associated impacts of development are the most significant threats into the future.

General Recovery Strategy

Improve Instream Habitat Quality and Quantity

It is unlikely that returning riparian corridors to properly functioning condition will address instream habitat conditions in a timely manner. While improved riparian function will ultimately increase wood recruitment into streams, near-term restoration measures will be required to fix degraded instream conditions. Recovery actions should focus on improving spawning habitat through placement of standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation in geomorphically appropriate stream reaches.

Winter LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should provide cover and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated that it threatens adjacent infrastructure.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a common problem throughout the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin, particularly those areas outside of Big Creek and CalPoly ownership. Areas identified as shallow or deep-seated landslides should be protected from future activities contributing to further instability. In particular, new roads and housing should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Restore Scott(s) Creek Estuary and Hydrologic Function of Lower Floodplain

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Santa Cruz Mountains diversity stratum. Restoration should address issues impairing water quality, water quantity, breeching, habitat availability, and habitat suitability. Efforts should focus on the ultimate causes of impairment as well as proximate issues limiting habitat suitability.

The Scott(s) Creek estuary presents unique opportunities for restoration. Removing the levees in the estuary and reestablishing the historical channel could significantly increase the available quantity of rearing habitat for steelhead. The proposed reconstruction of Highway 1 Bridge by Caltrans provides a rare opportunity to recreate one of the most important habitats for CCC steelhead: an estuary functioning near historical capacity. Lengthening the span of the bridge or moving the bridge further inland would remove a major geomorphic and hydrologic constraint to the estuary. Caltrans is currently investigating options for crossing and has been encouraged by multiple resource agencies to implement options to restore the estuary to its historical function.

The re-designation of lower Scott(s) Creek as a fish sanctuary, as enacted by the California Legislature between 1915 and 1943, should be considered an important conservation and educational tool to protect listed salmonids. In light of the potential re-establishment of the estuary's historical tidal prism with the Highway 1 bridge replacement project, a unique opportunity exists to restore, improve, and protect an extremely important environment for CCC steelhead. Designation of the lower watershed as a fish sanctuary could be evaluated as a conservation tool and applied to other watersheds if determined effective for conservation (and education) of anadromous fisheries resources. Outreach to affected landowners (i.e., CalPoly), the public (i.e., beach goers and the fishing community), and agencies (i.e., Santa Cruz County Parks, California Coastal Commission) should occur, and consideration of impacts of sanctuary designation should be evaluated and addressed to secure support from all affected landowners and user groups.

The steelhead fishery in the Scott(s) Creek estuary is the subject of recent research (e.g., Bond 2006; Hayes *et al*. 2008) by NMFS' Southwest Fisheries Science Center – Santa Cruz, which will likely continue into the future. Restoration and increased protection of the Scott estuary would provide numerous opportunities for additional published research. Research opportunities could include evaluation of changes to the steelhead population in response to restoration, and would provide important guidance for restorative actions on other estuaries in coastal California.

Continue Operation of the Scott Creek Lifecycle Station

NMFS Southwest Fisheries Science Center operates the only lifecycle station in the Santa Cruz Mountains Diversity Stratum on lower Scott(s) Creek. This station provides essential information on the population size of adult and smolt salmonids in Scott(s) Creek, and has been in continuous operation since 2003. Information from the station can be used to calibrate future surveys in streams in the Santa Cruz Mountains. Upgrades to the facility (i.e., construction of a permanent weir) would ultimately reduce operational costs, increase research opportunities, increase worker safety, and provide a more accurate estimate of the steelhead population in Scott(s) Creek. Continued operation is strongly recommended.

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NOAA FISHERIES
Scott Creek
CCC Steelhead Population
Mill
Boyer
Big
Scott Creek
Berry
Little
Winter
Archibald
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
Sacramento
San Francisco
San Jose
SAN JOAQUIN
CALIFORNIA
Central CA Coast Steelhead DPS
0
1
Miles
N

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% 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)	20 % streams/ 15% 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)	20% streams 3% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	70-79% Density rating "D" across IP-km	Fair

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawner per IP-km 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 <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	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)	40% streams/ 55% IP-km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	60% streams/ 85% IP-km (>40% average primary pool frequency)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	20% streams/ 15% 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)	20% streams/ 3% 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 <35	Very Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	3.8 Diversions/10 IP-km	Fair
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	100% streams/ 100% IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	40% streams/ 55% IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	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	>90% of Historical Range	Very Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	20% streams 15% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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		
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	40% streams 55% IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower		
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	20% streams 3% 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	3.8 Diversions/10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>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	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.104% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.478% 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	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	1.0 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	1.5 Miles/Square Mile	Poor

Scott Creek CAP Threat Results

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

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat										
ScC-CCCS-1.1.1.1	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).	2	5	CA Coastal Commission, CalPoly, CalTrans, NOAA SWFSC, USACE						TBD	Scott Creek estuary was reduced in size following European arrival and this habitat loss is currently believed to be a major limiting factor for salmonids. The upper estuary was converted for agricultural purposes, and much of the historical tidal prism is reduced due to channelization for the Highway 1 Bridge constructed in the early 1940's. Estuary/lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond et al., 2008). This recommendation includes restoration of complex habitat features such as large woody material to facilitate creation of deeper pools and cover. Steelhead will benefit from restoration during smolt transition and adult upmigration. In 2012, CalTrans, the County, RCDSCC, and a host of other stakeholders began a process to investigate bridge designs and restoration concepts for the lagoon area. This process is ongoing wiht a goal to develop a recommended bridge designa and restoration blueprint for the estuary.
ScC-CCCS-1.1.1.2	Action Step	Estuary	Remove structures impairing or reducing the historical tidal prism, where feasible, and benefits to salmonids and/or the estuarine environment are predicted. Work with Caltrans to restore estuary tidal prism as part of the proposed bridge replacement for the Highway 1 bridge over Scott Creek lagoon.	1	10	CA Coastal Commission, CalPoly, CalTrans, NOAA SWFSC						TBD	Caltrans is currently evaluating bridge replacement - differentiating between anticipated replacement costs and additional actions for steelhead recovery benefits can not be estimated at this time due to uncertainty regarding Caltrans preferred alternative. Replacement of the bridge offers a rare opportunity to restore two sharp bends to the lower channel and replace the leveed and straightened channel.
ScC-CCCS-1.1.1.3	Action Step	Estuary	Re-establish legislation designating the Scott Creek lagoon as a fish refuge.	2	10	Big Creek Lumber Co., CalPoly, CDFW, NMFS, NOAA SWFSC, Santa Cruz County						0	The lower portion of Scott Creek (potentially between the Highway 1 bridge and Little Creek), from the estuary to the confluence of Mill Creek was designated as a fish refuge from 1915 to 1943 by the California legislature. There are very few fish refuges in the US and implementation of this concept in this extremely important steelhead rearing area should be considered. Implementation of a refuge for fish could serve as a demonstration project for other potential areas. Action is considered In-Kind
ScC-CCCS-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ScC-CCCS-1.1.2.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	CalTrans, CDFW, Santa Cruz County	1.50	1.50				3	Cost of signs vary widely depending on materials used and content of signs. Assume $1,000/sign with a minimum of 3 signs for lagoon.

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-1.1.2.2	Action Step	Estuary	Monitor sandbar to evaluate timing and frequency of natural and artificial breaching events.	2	10	CalPoly, CalTrans, CDFW, NOAA SWFSC						0	Action is considered In-Kind
ScC-CCCS-1.1.3	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
ScC-CCCS-1.1.3.1	Action Step	Estuary	Highway 1 bridge reconstruction should restore historical river mouth dynamics to minimize delayed natural breaching.	1	10	CA Coastal Commission, CalPoly, CalTrans, Santa Cruz County						TBD	The major channel modification on Scott Creek is at the lagoon where Caltrans realigned (straightened) the stream to a new location for the original Highway 1 bridge. The original channel made a sharp bend to the west and then a second sharp bend at the cliff to enter the ocean. Both of these bends would have produced deep scour holes in the lagoon, serving as good feeding and transition habitat for down-migrating smolts. The sandbar at the mouth would also have been less likely to have delayed opening in the winter as currently occurs with the current alignment. Re-establishing the historical alignment will have major benefits to both steelhead and coho salmon.
ScC-CCCS-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
ScC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Encourage breaching of old levees in the lower riparian reaches of Scott Creek.	1	10	CalPoly, CDFW, NOAA SWFSC, Scotts Creek Watershed Council, USACE	63.67	63.67				127	Breaching will improve floodplain function and provide high water refuge for juvenile salmonids. Levees were constructed on the lower Scott Creek floodplain to facilitate farming and to concentrate and direct flows under the Highway 1 bridge in the estuary. These levees receive little if any maintenance, and in the riverine reach the levees are well vegetated. Nonetheless, the levees continue to impair habitat quality by reducing the extent of available winter refugia. The levees also reduce the total amount of rearing habitat in the estuary and reduce the extent and duration of floodplain connectivity. Cost estimate based on treating 3 miles (assume 1 project/mile in 25% High IP) at a rate of $42,448/mile.
ScC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Reclaim alcove and side channels for winter refugia and summer rearing.	1	15	Big Creek Lumber Co., CalPoly, Santa Cruz County, Scotts Creek Watershed Council						0	Cost accounted for in above action steps.

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-2.1.1.3	Action Step	Floodplain Connectivity	Where feasible, decommission or relocate elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	20	Big Creek Lumber Co., CalFire, CalPoly, Santa Cruz County						0	In areas where highly entrenched channels occur adjacent to structures, roads, and similar improvements, landowners often attempt to stabilize the streambanks to protect their property, which results in a net degradation of riparian and instream habitats. Due to the proximity of roads adjacent to stream channels, it is likely that future bank hardening will occur in the watershed. Some stream reaches in Scott Creek appear entrenched, and it is anticipated that future bank hardening will occur in some areas of the watershed. De-commissioning of these roads will preclude future bank hardening and should enhance floodplain connectivity. Cost accounted for in SEDIMENT.
ScC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-3.1.1	Recovery Action	Hydrology	Minimize redd scour										
ScC-CCCS-3.1.1.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5	Big Creek Lumber Co., CalPoly	774					774	Redd scour is likely a limiting factor in some reaches of Scott Creek, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of steelhead egg and alevin mortality. Cost based on $119,080/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $182,250 for treating 6.5 miles of high IP. Co-related to habitat complexity.
ScC-CCCS-3.1.1.2	Action Step	Hydrology	Review Habitat Complexity strategies.	3	20							0	Redd scour was identified as a limiting factor in the hydrology of Scott Creek. Recommendations to address this condition are included in the Habitat Complexity strategies.
ScC-CCCS-3.1.2	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-3.1.2.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.	2	20	CalPoly, CDFW, IWRP, Santa Cruz RCD, Scotts Creek Watershed Council, Trout Unlimited						TBD	The major land use requiring large quantities of water are the organic farms in lower Scotts Creek owned by CalPoly. Most of the water diverted comes from wells. Harvesting of water during the winter could reduce the potential impact that these wells may have on surface flows in lower Scott Creek. Cost will be determined when optimum acre feet per year is assessed to reduce impacts. Recommend initiating a hyrdological study at a rate of $74,195/project.
ScC-CCCS-3.1.2.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	1	20	Big Creek Lumber Co., CalFire, CalPoly, CDFW, Lockheed, SWRCB						TBD	
ScC-CCCS-3.1.2.3	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	2	10	CalPoly, Farm Bureau, IWRP, Santa Cruz RCD						0	Action is considered In-Kind
ScC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										
ScC-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. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility.	1	10		67.00	67.00				134	Cost based on treating 4.5 miles (1 project per mile in 50% high IP) at a rate of $29,640/mile.
ScC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Conduct a new habitat typing effort in Scott Creek.	3	5	Big Creek Lumber Co., CalPoly, CDFW	131.00					131	Scott Creek was last Habitat Typed in 1996. It is likely that a new effort is needed to determine changes in conditions to help prioritize instream restoration efforts. Efforts to improve habitat conditions in Scott Creek should not wait on the completion of Habitat Typing but should occur concurrently. Cost based on fish/habitat restoration at a rate of $130,941/project.
ScC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Identify historical CCC steelhead habitats lacking in channel complexity and initiate restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	1	15	Big Creek Lumber Co., CalFire, California Coastal Conservancy, CalPoly, CalTrans, CDFW, FEMA, NOAA RC, NRCS, Private Landowners, Santa Cruz RCD, Scotts Creek Watershed Council						TBD	Installation of instream habitat structures will help to create more instream channel stability in some reaches affected by redd scour. Cost accounted for in above action step.

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-6.1.1.4	Action Step	Habitat Complexity	Incorporate large woody debris (preferably large diameter redwood trees) into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	County of Santa Cruz, NRCS, Santa Cruz RCD, USACE						TBD	Cost will depend on number of stream bank protection projects identified in fish/habitat restoration assessment in Scott Creek. This number is unknown and will vary depending on water year. Cost of LWD may be less expensive in this watershed due to ongoing timber management actions.
ScC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	10	Big Creek Lumber Co., CalFire, CalPoly, CDFW, FishNet 4C, Monterey Bay Salmon and Trout Project, NMFS, Private Landowners, Santa Cruz County, Santa Cruz RCD, USFWS						0	Costs are anticipated to be lower in Scott Creek than in many of the more urbanized watersheds in the Santa Cruz Mtns Diversity Stratum due to the familiarity of many landowners with salmon and their habitat requirements. Action is considered In-Kind
ScC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency										
ScC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historic CCC steelhead streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	Big Creek Lumber Co., CalPoly, CDFW, County of Santa Cruz, Private Landowners, Santa Cruz RCD, Scotts Creek Watershed Council						0	Cost should be minimal because retention of LWD is typically a resource management policy versus physical process. Action is considered In-Kind

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-6.1.2.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	5	Big Creek Lumber Co., CalFire, CalPoly, Scotts Creek Watershed Council						0	Recovery actions should focus on improving spawning habitat through placement of standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation. Winter LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should provide cover and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated to threaten adjacent infrastructure.Costs accounted for in other recovery actions - See Hydrology.
ScC-CCCS-6.1.2.3	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	Big Creek Lumber Co., CalFire, CalPoly, Lockheed	67.00	67.00				134	Returning riparian corridors to properly functioning condition is unlikely to address instream habitat conditions in a timely manner. While improved riparian function will ultimately increase wood recruitment into streams, near-term restoration measures will be required to fix degraded instream conditions. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $1,674/acre.
ScC-CCCS-6.1.2.4	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	1	100	CDFW, Santa Cruz County, USACE						0	Action is considered In-Kind
ScC-CCCS-6.1.3	Recovery Action	Habitat Complexity	Improve shelter										
ScC-CCCS-6.1.3.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFW, Santa Cruz County, USACE						0	Action is considered In-Kind
ScC-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
ScC-CCCS-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Santa Cruz County	6.25	6.25	6.25	6.25		25	Costs will vary on landowner participation and year to year variation in rainfall patterns. This cost estimate does not include maintenance obligations.

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-8.1.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, NMFS, NRCS, RWQCB, Santa Cruz County, USACE, USFWS						0	This should be considered a standard business practice for all regulatory and oversight agencies. Action is considered In-Kind
ScC-CCCS-8.1.1.3	Action Step	Sediment	Restoration projects that upgrade or decommission high risk roads or other infrastructure in high priority areas should be considered an extremely high priority for funding (e.g., PCSRF).	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, CalPoly, CalTrans, NRCS, Santa Cruz County	21.00	21.00				42	Cost based on assumption of $13,680/mile to decommission 10% (~3 miles) of road network in the watershed. Road upgrades for the same 10% of the road network would equate to $71,820.
ScC-CCCS-8.1.1.4	Action Step	Sediment	Evaluate and remove roadside berms and other infrastructure that lead to increased runoff velocities and result in increased sediment discharge.	3	10	Big Creek Lumber Co., CalFire, CalPoly	35.91	35.91				72	Roadside berms are a common feature on many private and county roads in Santa Cruz County. Many of the private timberland roads have been upgraded and are hydrologically disconnected. A similar effort should occur on the remaining roads in the watershed. The cost of this action assumes 10% of roads (~3 miles) will be treated at a cost of $23,940/mile.
ScC-CCCS-8.1.1.5	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	10	Big Creek Lumber Co., CalFire, CalPoly	10.50	10.50				21	Costs to decommission 1.5 miles of riparian roads based on $13,680/mile. The costs are related to Roads and Railroads.
ScC-CCCS-8.1.1.6	Action Step	Sediment	Review Logging and Road/Railroad strategies.									0	Action is considered In-Kind
ScC-CCCS-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										
ScC-CCCS-11.1.1.1	Action Step	Viability	Continue operation of Scott Creek lifecycle station.	1	10	CalPoly, NOAA SWFSC						0	Scott Creek is the only lifecycle station in the Santa Cruz Mountains Diversity Stratum currently in operation. Operations should continue and upgrades to the weir will likely be necessary for calibration purposes pursuant to recommendations in the Coastal Monitoring Program. Costs accounted for in Monitoring Chapter.
ScC-CCCS-13.1	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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ScC-CCCS-13.1.1.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	3	100	California Coastal Conservancy, California Geological Survey, CalTrans, CDFW, FEMA, NMFS, NRCS, RWQCB, Santa Cruz County, Santa Cruz RCD, USACE, USFWS						0	This recommendation should be adopted as a standard practice for all agencies and consulting firms involved in actions to address channel and bank stability. Action is considered In-Kind
ScC-CCCS-13.1.1.2	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	3	100	CalTrans, CDFW, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-13.1.1.3	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. where critical infrastructure is located) for bank hardening projects.	3	100	California Coastal Conservancy, CalTrans, FEMA, NMFS, NRCS, RWQCB, Santa Cruz County, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-13.1.1.4	Action Step	Channel Modification	Avoid or minimize the effects of flood control projects on steelhead habitat	2	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Lockheed, Santa Cruz County, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-13.1.1.5	Action Step	Channel Modification	For riparian roads, promote road relocation as a preferred alternative to bank stabilization.	2	100	Big Creek Lumber Co., County of Santa Cruz, Santa Cruz RCD, USACE						0	Review Road/Railroad strategies for additional detail.
ScC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
ScC-CCCS-13.1.2.1	Action Step	Channel Modification	Minimize the use of rip-rap in future bank stabilization projects. Thoroughly evaluate all alternatives to rip-rap, and at a minimum, incorporate complexity features into stabilization projects.	3	100	Big Creek Lumber Co., CalPoly, NRCS, Santa Cruz County, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-13.1.3	Recovery Action	Channel Modification	Prevent or minimize adverse alterations to riparian species composition and structure										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-13.1.3.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.	3	100	CalFire, CalPoly, Caltrans, Santa Cruz County, Santa Cruz RCD, Scotts Creek Watershed Council, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-13.1.4	Recovery Action	Channel Modification	Prevent or minimize impairment to watershed hydrology										
ScC-CCCS-13.1.4.1	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.	3		Santa Cruz County						TBD	
ScC-CCCS-13.1.4.2	Action Step	Channel Modification	Breach existing levees in lower Scott Creek.	3	10	CA Coastal Commission, CalPoly, County of Santa Cruz, RWQCB, Santa Cruz RCD, Scotts Creek Watershed Council	48.00	48.00				96	This action was developed by CalPoly as part of the Queseria Creek restoration project. This action should be closely coordinated with the SWFSC and their monitoring program in the watershed. Breaching of levees could improve over wintering conditions for salmonids in lower Scott Creek. Cost are based on treating 2.25 miles (assume 1 project/mile in 25% high IP) at a rate of $42,408.
ScC-CCCS-13.2	Objective	Channel Modification	Address the inadequacy of existing regulatory mechanisms										
ScC-CCCS-13.2.1	Recovery Action	Channel Modification	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ScC-CCCS-13.2.1.1	Action Step	Channel Modification	Avoid or minimize the effects of channelization projects on steelhead habitat	1	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, CDFW, Santa Cruz County, Scotts Creek Watershed Council, USACE						0	Stream channels in Scott Creek have been modified through three methods: (1) channel straightening and levee construction, (2) removal of instream structure, and (3) bank stabilization to protect roads. These actions have impaired floodplain connectivity in some stream reaches. Remaining areas should be protected. Action is considered In-Kind
ScC-CCCS-15.1	Objective	Fire/Fuel Management	Address other natural or manmade factors affecting the species continued existence										
ScC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire						0	This recommendation should be considered a standard practice. Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities. Action is considered In-Kind
ScC-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						0	Standard practice. Action is considered In-Kind
ScC-CCCS-15.1.1.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire						0	Some areas in the Scott Creek watershed have a high fire hazard rating according to CalFire data. A major fire occurred in the watershed in 2009. While fuel loading has been reduced following the 2009 fire, future wildfires are probable. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the altered rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures would likely result. Action is considered In-Kind
ScC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ScC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	2	100	CalFire						0	Action is considered In-Kind
ScC-CCCS-15.1.2.2	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire						0	Action is considered In-Kind
ScC-CCCS-15.2	Objective	Fire/Fuel Management	Address the inadequacy of existing regulatory mechanisms										
ScC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ScC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC steelhead.	1	100	CalFire						0	This recommendation should be adopted as standard practice. Action is considered In-Kind

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	Encourage CalFire to provide a fire contingency plan to all non-County firefighters when providing firefighting assistance in the Scott Creek watershed (and all other watersheds in the County).	1	5	CalFire						0	Cost of providing the plan is minimal. Action is considered In-Kind
ScC-CCCS-15.2.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire						0	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions. Action is considered In-Kind
ScC-CCCS-15.2.1.4	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3		CalFire, Santa Cruz County						0	Action is considered In-Kind
ScC-CCCS-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology										
ScC-CCCS-15.2.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	2	100	CalFire						0	Avoid drafting water by helicopter from the Scotts Creek lagoon and obtain water from the nearby Pacific Ocean. Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting. Action is considered In-Kind
ScC-CCCS-15.2.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
ScC-CCCS-15.2.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	5	CalFire, CDFW, NMFS, NRCS, Santa Cruz County, USFWS						0	Review of prescribed fire plans is standard practice. Additionally, costs are developed for the Aptos watershed and the fire plan could be used in the Scott watershed. Action is considered In-Kind
ScC-CCCS-16.1	Objective	Fishing/Collecting	Address the inadequacy of existing regulatory mechanisms										
ScC-CCCS-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity										
ScC-CCCS-16.1.1.1	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along Scotts Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	1	5	CDFW, Santa Cruz County, Scotts Creek Watershed Council	38.00					38	Cost of signs varies widely. Assume $500/sign with a minimum of 15 signs.
ScC-CCCS-16.1.1.2	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	2	100	CDFW						0	Action is considered In-Kind
ScC-CCCS-16.1.1.3	Action Step	Fishing/Collecting	Prohibit offshore salmon fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	2	20	CDFW						0	This recommendation is associated with environmental regulatory policy. Action is considered In-Kind
ScC-CCCS-16.1.1.4	Action Step	Fishing/Collecting	Work with CDFW to modify the low flow minimum flow closure in Title 14, Section 8.00(b)(1) of the California Code of Regulations to include Scott Creek	2	5	CDFW, NMFS, Public						0	Low flow closures are needed for Scott Creek and should be based on flow gage information from a local watershed. Action is considered In-Kind

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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ScC-CCCS-16.1.1.5	Action Step	Fishing/Collecting	Work with California Fish and Game Commission to modify the dates of fishing season to be to at least January 15. Consideration should be given to pushing the entire fishing season back so that the total number of fishing days is not reduced significantly.	2	5	California Fish and Game Commission, NMFS, Public						0	Action is considered In-Kind
ScC-CCCS-16.1.1.6	Action Step	Fishing/Collecting	Work with CDFW to improve the Fishing Regulation manual to clearly identify differences in body morphology of all potentially present adult salmonids with color photos of diagnostic features (e.g., caudal fin spotting, caudal fin shape, coloration of lower jaw, peduncle width, etc.).	1	3	CDFW, NMFS						0	Action is considered In-Kind
ScC-CCCS-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ScC-CCCS-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize impacts to off channel habitat, floodplains, ponds, and oxbows.	2	100	Big Creek Lumber Co., CalFire, CalPoly						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)										
ScC-CCCS-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	3	100	Big Creek Lumber Co., CalFire, CalPoly						0	Temporary road surface treatments such as Dope30 should be evaluated. Action is considered In-Kind
ScC-CCCS-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
ScC-CCCS-19.1.3.1	Action Step	Logging	Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	2	100	Big Creek Lumber Co., CalFire, CalPoly, CDFW						0	Logging is a potential future threat to summer rearing juveniles due to the potential of timber management to reduce future recruitment of LWD into stream channels and increase instream temperatures. California Forest Practice Rules require retention of riparian trees adjacent to Class 1 fish bearing streams, which will ameliorate the impacts of reduced LWD and overstory canopy reduction. Santa Cruz County rules do not allow even aged management. Action is considered In-Kind
ScC-CCCS-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	Big Creek Lumber Co., CalFire, CalPoly, Private Landowners, RPFs, RWQCB						0	Cost should be minimal as it is anticipated this recommendation will only be implemented as part of an approved timber harvest plan. This effort should prioritize areas adjacent to high value IP habitat. Cost accounted for in above action step.

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ScC-CCCS-19.1.3.3	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	100	Big Creek Lumber Co., CalFire, CalPoly, CDFW, County of Santa Cruz, Private Landowners, RWQCB						0	Some costs may be incurred by landowner depending on management philosophy. Action is considered In-Kind
ScC-CCCS-19.1.4	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
ScC-CCCS-19.1.4.1	Action Step	Logging	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, County of Santa Cruz						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-19.1.4.2	Action Step	Logging	Minimize new road construction in riparian zones (< 100 feet).	2	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Santa Cruz County						0	This recommendation should be considered standard practice. Action is considered In-Kind
ScC-CCCS-19.1.4.3	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	5	Big Creek Lumber Co., CalFire, CalPoly, CDFW, County of Santa Cruz, RPFs						0	Financial impact will depend on rate of harvest in the watershed. Overall costs should be minimal. Action is considered In-Kind
ScC-CCCS-19.1.4.4	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	100	Big Creek Lumber Co., CalFire, CalPoly, CDFW, County of Santa Cruz, RPFs						0	Most of these costs will likely be associated with planned ongoing harvest.
ScC-CCCS-19.1.4.5	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	100	CalFire, California Department of Mines and Geology, CDFW, County of Santa Cruz, RWQCB						TBD	This cost is expected to be minimal because these areas should be identified prior to permitting by appropriate regulatory agencies. Cost to conduct conducting sediment assessment at a rate of $1,403/acre. These data should be held in a central repository by either the County of Santa Cruz and or CalFire.
ScC-CCCS-19.1.5	Recovery Action	Logging	Prevent or minimize reduced density, abundance, and diversity										
ScC-CCCS-19.1.5.1	Action Step	Logging	Devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with steelhead recovery priorities.	3	50	County of Santa Cruz, Santa Cruz RCD, State						0	Action is considered In-Kind

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ScC-CCCS-19.1.5.2	Action Step	Logging	Encourage a watershed-wide HCP for all or multiple landowners within a watershed to pool resources as a means to facilitate long-term survival and recovery of salmonids and their habitat.	3	30	Big Creek Lumber Co., CalPoly, CDFW, NMFS, Private Landowners, State Parks, USFWS	100.00	100.00	100.00	100.00	100.00	600	If existing information is adequate regarding watershed conditions for covered species, it will reduce overall costs considerably. However, if HCP negotiations are contentious and protracted, costs could increase considerably.
ScC-CCCS-19.1.5.3	Action Step	Logging	Review Road/Railroad strategies for additional recommendations.	3	100							0	Action is considered In-Kind
ScC-CCCS-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
ScC-CCCS-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
ScC-CCCS-19.2.1.1	Action Step	Logging	Work with CalFire and the county to review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County, State						0	Applications are currently approved without review. Action is considered In-Kind
ScC-CCCS-19.2.1.2	Action Step	Logging	Maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture or other land uses.	3	50	CalFire, Santa Cruz County, State						TBD	
ScC-CCCS-19.2.1.3	Action Step	Logging	Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.	3	30	CalFire, Santa Cruz County, State						0	Action is considered In-Kind
ScC-CCCS-19.2.1.4	Action Step	Logging	Discourage Santa Cruz County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	60	CalFire, Santa Cruz County, State						0	Costs should be minimal if Santa Cruz County readily adopts this recommendation.
ScC-CCCS-19.2.1.5	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	60	Big Creek Lumber Co., Board of Forestry, CalPoly, CDFW, County of Santa Cruz						0	Action is considered In-Kind
ScC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ScC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ScC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	2	10	Big Creek Lumber Co., CalFire, CalPoly, RWQCB, Santa Cruz County Department of Public Works	14.00	14.00				28	Cost for a road inventory of 26 miles of road estimated at $1,090/mile. Number of culverts and feasibility of energy dissipaters should be identified from road assessment.
ScC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFW, RWQCB						0	Action is considered In-Kind

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Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	10	Big Creek Lumber Co., CalFire, Lockheed, Scotts Valley Water District	14.50	14.50				29	This is a long term plan that would require cooperation from the majority of the landowners in the watershed. It is unknown if this is a feasible alternative for Scott Creek. Primary emphasis should be placed on removing riparian roads with high sediment delivery potential adjacent to key spawning and rearing areas. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on $14,131/mile to decommission 1.5 miles of riparian roads.
ScC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to the estuary (impaired quality and extent)										
ScC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Relocate or extend the proposed replacement bridge for Highway 1 over Scott Creek in order to allow Scott Creek to re-establish its historical outlet into the ocean. Relocating or extending the replacement bridge could facilitate the re-establishment of the historical tidal prism in the lower lagoon.	1	10	CalPoly, CalTrans, CDFW, NMFS, Santa Cruz County						TBD	Increased costs may be associated with the proposed recommendation but this information is currently unavailable. This is a very rare opportunity to re-establish an estuary to historical conditions. This is also an opportunity to proactively address impacts of sea level rise so as to not further impair the estuary with additional bank stabilization features and channelizing. See ESTUARY for more information.
ScC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										
ScC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	3	10	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Santa Cruz County	222.50	222.50				445	Cost based on $74,190/unit for 6 identified stream crossings.
ScC-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize reduced density, abundance and diversity										
ScC-CCCS-23.1.4.1	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.	2	100	Big Creek Lumber Co., CalFire, CalTrans, County of Santa Cruz, RWQCB, Santa Cruz RCD	0.50	0.50	0.50	0.50	0.50	10	Ongoing programs, such as FishNet 4C, could facilitate this recommendation. Costs are difficult to estimate on a watershed basis. Such a program would likely be focused on County and State maintenance staff who cover a large region and many of the key watersheds targeted for salmonid.
ScC-CCCS-23.1.4.2	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	40	Big Creek Lumber Co., CalFire, CalPoly, CDFW, County of Santa Cruz, Farm Bureau, RWQCB						TBD	This is a long term plan that would require cooperation from the majority of the landowners in the watershed. It is unknown if this is a feasible alternative for Scott Creek. Primary emphasis should be placed on removing riparian roads with high sediment delivery potential adjacent to key spawning and rearing areas and areas adjacent to high value IP habitat. Cost accounted for in county planning for future road construction and/or above action steps.
ScC-CCCS-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-23.1.5.1	Action Step	Roads/Railroads	Address sediment sources from road networks and other actions that deliver sediment to stream channels.	3	20							0	Cost accounted for in above actions step.
ScC-CCCS-23.1.5.2	Action Step	Roads/Railroads	Provide and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	2	60	Big Creek Lumber Co., CalFire, CalPoly, Farm Bureau, NRCS, RWQCB, Santa Cruz County Department of Public Works, USACE	3.33	3.33	3.33	3.33	3.33	40	A culvert inventory is needed.
ScC-CCCS-23.1.5.3	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	Big Creek Lumber Co., CalFire, CalPoly, Farm Bureau, NRCS, Private Landowners, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD, USACE	5.00	5.00	5.00	5.00		20	Roadside berms are a common feature on many private and county roads in Santa Cruz County. Many of the private timberland roads have been upgraded and are hydrologically disconnected. A similar effort should occur on the remaining roads in the watershed. The cost of this effort cannot be estimated until a complete watershed wide inventory in conducted.
ScC-CCCS-23.1.5.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	60	Big Creek Lumber Co., CalFire, CalPoly, CDFW, NRCS, RWQCB, Santa Cruz RCD, USACE						TBD	Cost will vary depending on the number of culvert upgrades on the road network and the maintenance requirements and accessibility. An inventory of the culvert system is necessary before costs can be estimated.
ScC-CCCS-23.1.5.5	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.	2	5	CalPoly, County of Santa Cruz, Private Landowners, RWQCB						0	Action is considered In-Kind
ScC-CCCS-23.1.6	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
ScC-CCCS-23.1.6.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100							0	Action is considered In-Kind
ScC-CCCS-23.1.6.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	40	Big Creek Lumber Co., CalFire, CalPoly, RWQCB, Santa Cruz County, USACE						0	Cost accounted for in above action steps.
ScC-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ScC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Reduce sediment sources from road networks, maintenance activities, and other actions that deliver sediment to stream channels through improved, or new, laws and policies, and/or enforcement of existing laws and policies.	2	50	Big Creek Lumber Co., CalFire, CalPoly, RWQCB, Santa Cruz County, USACE						0	Action is considered In-Kind
ScC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in current and historical habitats.	1	10	Big Creek Lumber Co., CalFire, CalPoly, RWQCB, Santa Cruz County, USACE	21.00	21.00				42	Cost based on decommissioning 3 miles of road at a rate of $13,680/mile.
ScC-CCCS-23.2.1.3	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	10	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, RWQCB, Santa Cruz County						0	Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile of watershed area, and at 4.0 miles per square mile of riparian area. Many of these roads are poorly situated, unpaved, and are sources of chronic sediment input. Paved and unpaved roads parallel many of the waterways within Scotts Creek and impinge upon channel migration. Some roads in the watershed are used for timber harvest and receive heightened levels of maintenance and review, as least for a short time (currently three years) following completion of a timber harvest plan. A well designed road management plan should result in overall cost savings due to reduced flood fighting actions, and stream bank and road stabilization projects. Action is considered In-Kind
ScC-CCCS-23.2.1.4	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	1	100	Big Creek Lumber Co., CalFire, CalPoly, Lockheed, Private Landowners, Santa Cruz County						0	This should be considered a standard road management practice for all landowners. Action is considered In-Kind
ScC-CCCS-23.2.1.5	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	Big Creek Lumber Co., CalFire, California Geological Survey, CalPoly, RWQCB, Santa Cruz County						0	This is a cost that is frequently absorbed into new road projects and should be considered a standard business practice.

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-23.2.1.6	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	100	Big Creek Lumber Co., CalFire, California Geological Survey, CalPoly, NRCS, Private Landowners, RPFs, RWQCB, Santa Cruz County, Santa Cruz RCD						TBD	These practices should be adopted as part of future road actions and maintenance practices.
ScC-CCCS-23.2.1.7	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	Big Creek Lumber Co., CalFire, Private Landowners						TBD	This recommendation may involve increased intra-watershed coordination among the landowners (locking and installing gates, etc.). Cost likely accounted for in road inventory.
ScC-CCCS-23.2.1.8	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, Santa Cruz County						0	
ScC-CCCS-23.2.1.9	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, CDFW, County of Santa Cruz, Private Landowners						0	A well designed road management plan should result in overall cost savings due to reduced flood fighting actions, and stream bank and road stabilization projects. Action is considered In-Kind
ScC-CCCS-23.2.1.10	Action Step	Roads/Railroads	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe.	1	10	County of Santa Cruz	25.00	25.00				50	Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary. Costs are estimated for Scott Creek watershed only. Costs are an estimate of County staff time.
ScC-CCCS-24.1	Objective	Severe Weather Patterns	Address the overutilization for commercial, recreational, scientific or educational purposes										
ScC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity										
ScC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	2	100	CDFW Law Enforcement, NMFS OLE						0	Costs are expected to be absorbed into ongoing activities. Action is considered In-Kind
ScC-CCCS-24.2	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
ScC-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC steelhead in any flood management activity (CDFG 2004).	1	100	Big Creek Lumber Co., CalPoly, CDFW, FEMA, Private Landowners, Santa Cruz County, Scotts Creek Watershed Council, USACE						0	Wood in the past was frequently cut up in Scotts Creek due to fears by some landowners that it will lead to increased flooding and property damage. These practices adversely affect the summer and winter rearing lifestages. Low LWD abundance in the lower portion of Scotts Creek is likely the result of past logging practices that removed trees from riparian areas, followed by Santa Cruz County funded stream clearance efforts following the 1982 flood. Santa Cruz County has essentially stopped removing LWD since 2009. Low instream LWD volume is likely the major contributor to the lower shelter values estimated in the watershed; only 20 percent of stream reaches had a shelter value >80, which constituted less than three percent of available IP. Maintaining wood is essential to improving habitat conditions and should be a major consideration for future flood management actions. Action is considered In-Kind
ScC-CCCS-24.2.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
ScC-CCCS-24.2.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	10	Big Creek Lumber Co., CalFire, CalPoly, Santa Cruz County	34.00	34.00				68	Extreme flood events such as those that occurred in 1955 and 1982 could result in major sediment input from upslope locations. Changes and improvements to land-use practices (i.e., avoiding road construction at the toe of a landslide) will likely result in lower sediment yields following future flooding events than were likely experienced after the 1955 and 1982 floods. However, future severe weather events could slow the rate of recovery of instream habitat conditions. Cost for erosion assessment estimated at $14.36/acre. (assume 25% of total watershed acres).
ScC-CCCS-24.2.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
ScC-CCCS-24.2.3.1	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	2	100	FEMA, NRCS, RWQCB, Santa Cruz County, USACE						0	Avoiding building in channel migration zones can result in long term cost saving due to reduced flood fighting and consequent stabilization measures. Action is considered In-Kind
ScC-CCCS-24.2.3.2	Action Step	Severe Weather Patterns	Adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	3	100	FEMA, Private Landowners, Santa Cruz County, USACE						0	Some infrastructure may be relatively easy to remove while other infrastructure will be extremely difficult. This recommendation should be viewed as an opportunistic strategy in Scott Creek. Action is considered In-Kind
ScC-CCCS-24.2.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-24.2.4.1	Action Step	Severe Weather Patterns	Establish and enforce minimum summer releases from the Mill Creek reservoir to ensure rearing habitat is maintained in Mill Creek.	1	5	CDFW, Lockheed, NMFS, SWRCB	45.00					45	This important steelhead rearing stream dried down to isolated pools during the drought years of 1988, 2007, and 2008. A contingency plan should also be developed to provide a pulse release from the reservoir in drought years to facilitate adult entry (for broodstock capture for the hatchery) as well as for wild spawning.
ScC-CCCS-24.2.4.2	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with CCC steelhead recovery needs.	2	10	Big Creek Lumber Co., CalFire, CalPoly, CDFW, Monterey Bay Salmon and Trout Project, NMFS, Santa Cruz County, Scotts Creek Watershed Council, SWRCB	20.00	20.00				40	Impacts of a severe drought in conjunction with ongoing water diversion could affect all lifestages of steelhead in the watershed. A severe drought could reduce total water yield and delay or limit adult steelhead migration to spawning areas; reduce juvenile rearing habitat; and expose winter rearing, summer rearing, and smolt salmonids to increased predation. Work with CDFW, SWRCB, Scotts Creek Watershed Council, and knowledgeable biologist to develop emergency rules and adopt implementation agreements. Emergency rules should be sure to include diversions in upper Mill Creek where contingency emergency releases should be addressed to provide for adult passage in drought year (this would at least allow adult steelhead to enter the stream where they could be captured broodstock for the Kingfisher Flat Restoration Hatchery.
ScC-CCCS-24.2.4.3	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	Big Creek Lumber Co., CalPoly, CDFW, NMFS, RWQCB, SWRCB						0	Action is considered In-Kind
ScC-CCCS-24.2.4.4	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	3	100	CDFW, NMFS, Scotts Creek Watershed Council, SWRCB						0	Action is considered In-Kind
ScC-CCCS-24.2.4.5	Action Step	Severe Weather Patterns	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of steelhead and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	2	50	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
ScC-CCCS-24.2.4.6	Action Step	Severe Weather Patterns	Encourage CalFire to modify water right for diversion in upper headwaters of Scott Creek.	3		CalFire, CDFW, NMFS, SWRCB						0	Action is considered In-Kind
ScC-CCCS-24.2.4.7	Action Step	Severe Weather Patterns	Evaluate the impacts of water diversions and dams on the water flow in Boyer Creek (trib to Big Cr)	3	5	CDFW, NMFS, Private Landowners, SWRCB						0	Action is considered In-Kind
ScC-CCCS-24.3	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										

Scott Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCCS-24.3.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										
ScC-CCCS-24.3.1.1	Action Step	Severe Weather Patterns	Work with water users to minimize depletion of summer base flows.	1	100	Big Creek Lumber Co., CalPoly, Lockheed, Private Landowners, Scotts Creek Watershed Council, SWRCB						0	Bypass flows at the Mill Creek dam should be the first area of focus, particularly during dry water years. Cost for maintaining minimum summer base will be determined once a streamflow assessment has been conducted. This cost has been accounted for in above action step.
ScC-CCCS-24.3.1.2	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	2	20	CalPoly, CalTrans, IWRP, USACE						0	Cost accounted for in ESTUARY.
ScC-CCCS-24.3.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology										
ScC-CCCS-24.3.2.1	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	100	Big Creek Lumber Co., CalPoly, Lockheed, SWRCB						TBD	The cost for water conservation strategies will depend upon the type of each strategy, the feasibility to implement, and the willingness of water users to implement.
ScC-CCCS-24.3.2.2	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for steelhead, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	1	10	Big Creek Lumber Co., CalPoly, CDFW, NMFS, Private Landowners, SWRCB	37.00	37.00				74	Cost for stream flow model estimated at $74,195/project. This action step could coordinate with additional action steps to avoid redundancy in cost.
ScC-CCCS-24.3.2.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for steelhead recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (Water Code § 1707).	3	100	California Coastal Conservancy, CalPoly, Lockheed, NRCS						TBD	The price water is sold on environmental markets is determined by negotiations between landowners and purchasing entity. In circumstances where potential agricultural sellers of water rights do not shift to groundwater pumping or make other arrangements such that lands are not left fallow, potential sellers may forgo the agricultural profits they would have gained from irrigating. Cost will vary depending on water availability and landowner participation. It is unknown if this program will gain widespread acceptance in the watershed and therefore costs cannot be estimated. However, it is recommended that the equations used in the State Coho Plan for socioeconomic costs be utilized when more information regarding landowner participation is gathered. Water Acquisitions are estimated to range between $87 - 650/acre-foot.

Soquel Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 1,800 adults
- Current Intrinsic Potential: 52.0 IP-km

Steelhead Abundance and Distribution

The Soquel Creek watershed is located near the southern end of the Santa Cruz Mountains in Santa Cruz County. It is the second largest watershed located completely within Santa Cruz County, with a drainage area of approximately 42 square miles. Before flowing into Monterey Bay, Soquel Creek forms an estuary that provides important salmonid habitat. The watershed has two major tributary basins in the upper watershed, the East Branch and the West Branch, and one major tributary basin, Bates Creek, in the lower watershed. The respective drainage areas of these tributary basins are 18, 13, and 5 square miles. Significant smaller tributary streams in the East Branch include Amaya Gulch and Hinckley Creek, and in the West Branch, Hester Creek. The total length of fish-bearing streams in the watershed is approximately 50 miles (SCCRCD 2003). Watershed relief is dramatic in the Soquel Creek basin, with elevations in the headwaters reaching over 3,000 feet only 10 miles from the mouth (Balance Hydrologics, Inc. 2003). This dramatic change in relief is partially attributed to both the San Andreas and Zayante fault zones in the upper watershed (SCCRCD 2003). There are three significant barriers that limit salmonid distribution in the upper watershed: Girl Scout Falls 1 and 2 on the West Branch, and Ashbury Falls on the East Branch (Alley et al. 2004).

Soquel Creek was historically one of the most important steelhead spawning and rearing streams in Santa Cruz County (Titus *et al*. 2010). Based on data collected by CDFW during surveys in 1959 and 1962, the juvenile abundance (approximately 17,500 fish) corresponded to an adult steelhead run of approximately 500-1,000 spawning pairs (Evans 1962, as cited in Titus et al. 2010). A 1996 estimate of the steelhead run size in Soquel Creek was about 100 individuals (Sutfin 1996, as cited in Becker and Reining 2008). Indices of adult returns to the West Branch and mainstem Soquel Creek averaged 523 between 1997 and 2005 (Alley 2006).

The Soquel Creek lagoon typically produces 10-35 percent of the smolt-sized juveniles in the mainstem each year (Alley et al. 2004). A mark/recapture study of the lagoon's juvenile steelhead population in fall 2006 produced an estimated 992 individuals, which was comparable to a 14-year average of about 1,160 individuals (Alley 2006). The 2009 juvenile steelhead

population in the lagoon was estimated at 449, appreciably less than estimated for 2008 (Alley 2010).

A report on juvenile steelhead density in the mainstem notes especially low densities, particularly in the lower mainstem (Alley 2007). Estimated smolt densities at four sites ranged from 2.8 to 9.1 per 100 feet of stream, compared to a range of 1.2 to 41.6 per 100 feet throughout the study area (Alley 2007). In Soquel Creek, total densities were below average at six of eight sampled sites in 2009, with 9-13 years of data (Alley 2010). West Branch Soquel Creek juvenile steelhead smolt densities were estimated at three sites and ranged from 4.7 to 14.1 per 100 feet of stream. In 2009, smolt densities in East Branch and West Branch Soquel Creek ranged from 6.8 to 14.1 per 100 feet of stream (Alley 2010). In 2012, juvenile steelhead densities throughout the Soquel Creek watershed were near average with the exception of the upper East Branch which was well below the average dating back to 1998 (Alley 2013).

History of Land Use

Logging was the dominant land use within the Soquel Creek watershed. For the period of 1870 through 1942, roughly half of the entire East Branch forest canopy was harvested (Balance Hydrologics, Inc. 2003). Logging was conducted in the middle and upper watershed since the mid-19th century (Santa Cruz County Resource Conservation District 2003). There were approximately 31 mills in the watershed between 1840 and 1905 (National Marine Fisheries Service 2011). Today, a significant portion of the watershed consists of small rural residential ownership parcels. The city of Capitola is located at the mouth of Soquel Creek.

Current Resources and Land Management

Lands in the Soquel Creek watershed are situated mostly in the unincorporated portion of Santa Cruz County; the lower portion of the creek is within the City of Capitola. Land uses in the watershed include urban development, rural residential development, agriculture, parks and recreation, mining, and timber harvesting (Santa Cruz County Resource Conservation District 2003).

The majority of the upper and middle watershed is occupied by rural residential use, along with a portion of a state park, a granite quarry, and Soquel Demonstration State Forest. Roughly 25 percent of the upper reaches of the creek and its major tributaries emanate from State land made up of two large parcels with extensive open-space holdings supporting redwoods, grasslands and mixed woodlands. The lower reaches of Soquel Creek flow through a residential and mixed-use urban area (Capitola and the unincorporated community of Soquel) (Santa Cruz County Resource Conservation District 2003). Each summer, the City of Capitola

regulates summer water levels in the Soquel Creek lagoon by manually closing the sandbar that is equipped with a concrete flume (SCCRCD 2003; Alley et al. 2004).

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated "Poor" through the CAP process: habitat complexity, sediment transport, hydrology, and water quality. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

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

Estuary: Quality & Extent

Estuary/lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond *et al*. 2008). The Soquel estuary has been reduced in size following settlement and subsequent urbanization surrounding the lagoon. The extent of urbanization within the lagoon's historical footprint has eliminated most of the adjacent marsh habitat, impacted water quality (i.e., nutrient loading and episodes of eutrophication), and restricted the total depth of the lagoon by limiting the quantity of water that can be impounded (i.e., seasonal installation of a flume on the beach). During late winter and spring and when the sandbar is open, portions of the estuary that retain sufficient residual depth are especially important to steelhead because they provide areas for rapid feeding and saltwater transition for emigrating smolts; such habitats are limited in the Soquel estuary. Draining of the estuary by illegal breaching or by vandalism of the flume remains a concern.

Sediment Transport: Road Density

Excessive sediment transport rates in the Soquel watershed have compromised steelhead spawning and rearing habitat. Pool filling appears to be occurring from sediment transported from upslope sources. Sources that alter sediment transport include urbanization, agriculture, roads, and logging.

Habitat Complexity: Large Wood & Shelter

According to NHI (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. Therefore LWD is an even more critical habitat element than in more northern streams in forming pools or areas of refuge from high flows. The SCCRCD (2003) documented large instream wood was extremely scarce in Soquel Creek compared to other coastal streams in the Santa Cruz Mountains. Low large wood abundance in Soquel Creek is likely the result of past logging practices that removed trees from riparian areas which would have recruited into the various watercourses. This was followed by Santa Cruz County funded stream clearance efforts after the 1982 flood. Following implementation of these wood clearing efforts, one of the critical lessons learned by the County was that stream clearing prior to storms did not reduce logjams yet in many cases led to worse conditions because instead of logs and debris being more evenly distributed throughout the river, wood accumulations that were missed during clearing consolidated into much larger masses. Santa Cruz County has essentially stopped removing LWD since 2009, but unauthorized instream removal of LWD continues from private landowners in the watershed. Available information indicates unauthorized removal is particularly prevalent in the stream reach below the West Branch confluence. The lack of instream wood is likely the major contributor to the lower shelter values recorded in the watershed (no stream reaches had a shelter value >80). Wood abundance is extremely low; the SCCRCD (2003) found only 92 pieces of LWD over a distance of approximately 53,856 feet. This average of 0.56 pieces of wood per hundred meters deviates substantially from LWD targets adopted by NMFS to reflect properly functioning conditions

Hydrology: Redd Scour and Hydrology: Baseflow & Passage Flows

Streamflow in Soquel Creek is reduced by water diversions and groundwater pumping adjacent to the channel. The relationship between water use and streamflow is complicated by the number of water users, types of diversions (direct and streamside wells), and the lack of coordination between users. Soquel is an adjudicated watershed. Balance Hydrologics, Inc. (2003) reported that minimum period (late summer and early fall) baseflows have decreased by two to four cfs, which has resulted in dry period baseflows of zero to two cfs since the 1950s. Low streamflow damages fish habitat by allowing pools and riffles to fill with sediment and reducing flow levels necessary for rearing and migration. Lost habitat reduces rearing space and lowers food availability, which can cause the steelhead population to decrease. During dry years, some areas that would normally be considered high value salmonid habitat go dry in Soquel Creek and result in death to all fish rearing in those affected stream reaches.

Residential development can increase the amount of impervious surface in the lower watershed, increasing the volume and speed of storm runoff entering creeks. This, in

combination with reduced instream complexity, increases the likelihood of redd scour during high flow events. The SCCRCD (2003) noted much of the streambed of Soquel is likely prone to scour, particularly along the mainstem. It was not known if scour is widespread or whether it significantly increases steelhead egg and alevin mortality.

Velocity Refuge: Floodplain Connectivity

The floodplain limitations present today in the Soquel watershed are primarily due to urbanization and existing roads. The associated impacts of these land use practices to channel confinement have resulted in riparian encroachment, channel degradation, and floodplain/stream channel disconnection. FEMA flood zone maps show significant overlap of areas designated as 100-year flood prone zones and areas with high housing and commercial density. Due to the high amount of development in these areas, the overall degraded condition of important floodplain habitat is expected to persist and likely worsen in the future.

Landscape Patterns

The most significant landscape disturbance within the Soquel Creek watershed is associated with residential development in the cities of Soquel and Capitola. This disturbance is most pronounced in areas along the downstream portions of the creek and floodplain areas down to the estuary. A large portion of the watershed is in private ownership (88 percent), and most of these are smaller parcels. In general, ownership patterns with a large proportion of small parcels are more likely to have chronic instream disturbance than larger parcels. The portions of the watershed with fewer detrimental sources of permanent disturbance are generally those areas where the primary land ownership is in State Parks, or where the primary land management is timber harvest, such as Soquel Demonstration State Forest.

The Soquel watershed consists of three distinctive geologic blocks separated by the San Andreas and Zayante fault zones (SCCRCD 2003). The distribution and activity of the major fault zones has contributed to a large number of landslides, which have periodically dumped large quantities of sediment to the watercourse. Additionally, short periods of net sediment aggradation within the stream channel have been documented following major floods (SCCRCD 2003). In reaction to large sediment input events, there is a potential for future bank destabilization due to bed aggradation as pulses of sediment move through the system.

Threats

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

efforts. The figures and tables that display data used in this analysis are provided in Soquel Creek CAP Results.

Fire and Fuel Management and Fire Suppression

Some areas in the Soquel watershed have a high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could significantly increase fine sediment input and further compromise the rate of large wood recruitment into affected stream channels. Furthermore, if existing riparian areas were lost to fire, higher water temperatures, which are already above optimal condition in many stream reaches, would likely result.

Roads and Railroads

Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile of watershed area, and at 4.0 miles per square mile of riparian area. Many of these roads are poorly situated and constructed, and improperly maintained. Even through chronic fine sediment production decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to many forms of erosion, including culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (ESA 2004). Legacy roads from past logging activity, having been adopted as year-round roads and recreational trails, continue to impact the Soquel watershed. On many roads, located on both public and private lands, periodic maintenance occurs without any attempt to address chronic, localized erosion problems. In these circumstances, grading poorly drained roads and repairing failed fills and stream crossings can continue, and even exacerbate, the rate of fine sediment delivery into streams. Additionally, paved and unpaved roads parallel many of the waterways within Soquel Creek, likely constraining natural channel migration.

Residential and Commercial Development

The 2010 census estimated the population within Soquel Creek at 15,986 individuals. Sixty-nine percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009), with much of the development located in close proximity to the various watercourses, particularly the lower mainstem. The proximity of residences to stream channels places riparian areas and stream channels at greater risk for future alterations. Many residences and commercial areas are prone to flooding and are located within the FEMA 100-year flood zone, and efforts to minimize the impacts of flooding will likely include removing instream habitat features, such as wood debris (this is a practice that is unauthorized, but still occurs with some private landowners concerned over potential flood risk). Residences located adjacent to stream

channels are often at increased risk of bank erosion, and efforts to protect existing infrastructure will likely include bank stabilization efforts that would likely further degrade salmonid habitat.

Severe Weather Patterns

Concentrated rainfall and extreme flood events could increase sediment input into Soquel Creek and tributaries from upslope locations. Much of the watershed is comprised of steep topography in erodible geology, which has led to frequent landslides. Accumulated fine sediment within the stream channel from upslope landslides has likely adversely impacted steelhead spawning and rearing habitats. Improved land-use practices will likely lower sediment yield rates following future flooding events. However, much of the watershed is considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions. Although large storms and flood events can increase large wood delivery to the stream and, in some cases, form complex instream habitats, the overall adverse impacts resulting from flood events in a developing watershed likely outweigh the potential benefits.

Due to the use of groundwater and heavy over-drafting of water from Soquel Creek, the impact of a severe drought in conjunction with ongoing overdraft of the aquifer and surface water diversions could be devastating to all lifestages of steelhead in the watershed. Although the watershed is Fully Appropriated and adjudicated, a water master is not appointed and there is no oversight of flow requirements. Required minimum bypass flows are not enforced for permitted surface water diversions and it is likely flows drop below mandated requirements in many stream reaches during the summer period. Additionally, even less oversight exists for ground water pumping in the watershed. Current demand for water exceeds the safe yield of local (downstream) aquifers and the lower aquifer is in danger of seawater contamination. Severe drought, particularly if occurring over a period of two or more years, would likely reduce flows significantly throughout the watershed, which would reduce overall steelhead abundance and compromise the overall viability of the Santa Cruz Mountains Diversity Stratum steelhead population.

Water Diversion and Impoundments

The watershed was designated as a Fully Appropriated Stream by the California State Water Resources Control Board and adjudicated by court order in 1978. A water master was not appointed as part of the court ordered adjudication and there is therefore little regulatory oversight of the terms and conditions of the adjudication. Surface water diversions and ground water pumping adversely impact almost all steelhead lifestages and are particularly deleterious during drought conditions. Additionally, water diversions reduce freshwater inflow to the estuary and extend the duration necessary for conversion to a freshwater lagoon during summer (this impact is somewhat offset by the City of Capitola's management of the sandbar).

Water diversions and ground water pumping, which have depleted the aquifer, coupled with degraded instream habitat conditions, significantly degrade juvenile rearing opportunities during the summer period. Some stream reaches go dry during the summer juvenile rearing period, and this drying is in large part a result of the added water use in the basin. A notable decline in baseflow has occurred in the watershed since the 1950s as measured at the USGS Soquel Creek gage during dry periods. Balance Hydrologics, Inc. (2003) reported that the decrease was characterized by a drop in baseflows of two to four cfs resulting in dry period baseflows of zero to two cfs. The most likely cause of the decreases in baseflow is surface diversions and near-stream groundwater pumping. The Soquel Creek Water District has a demand offset program where new connections contribute to a fund to pay for water conservation measures in existing homes and businesses in order to offset the new demand. Overall water use has decreased with this program. In addition, the Soquel Creek Water District has an ongoing program to measure well pumping impacts on stream flow and they provide education programs to schools within the district and conservation incentives (*e.g.,* lawn replacement) to property owners.

Channel Modification

Landowners adjacent to the destabilized stream channels typically harden stream banks, which ultimately degrades the riparian zone and compromises instream salmonid habitat. Modification and removal of woody instream structures is an ongoing practice in the watershed. As sediment moves downstream through a stream it is often held in place by instream structure such as wood. This stored sediment can provide important spawning and rearing habitats for salmonids. When large wood is removed, the sediment typically washes downstream and in many situations the stream channel will begin to downcut and become entrenched. A consequence of channel entrenchment is the stream banks become overly steepened and increasingly unstable. In areas where highly entrenched channels occur adjacent to structures, roads, and similar improvements, landowners often attempt to stabilize the stream banks to protect their property which results in a net degradation of riparian and instream habitats. Due to the concentrated urban and residential interface adjacent to the creek and estuary, future bank hardening will likely occur in the watershed.

Logging

Logging was identified as a potential future threat to summer rearing juveniles due to the potential of timber management to reduce future LWD recruitment and increase instream temperatures. California Forest Practice Rules require retention of riparian trees adjacent to Class 1 fish-bearing streams, which will ameliorate the impacts of reduced LWD and overstory canopy reduction (Santa Cruz County rules do not allow even-aged management). Despite these restrictions it is likely future timber management may reduce or delay the rate of future

recruitment by harvesting trees that could potentially be recruited into the stream channel. This impact could be partially offset if, as mitigation measures for future timber harvest plans, a large wood augmentation program was included into the harvest plan. An augmentation program would need to include an evaluation of limiting factors, including riparian canopy cover and instream temperature regimes.

Mining

Mining was listed as a potential future threat to summer-rearing juveniles due to existing sediment controls potentially failing during a major storm event. Only one quarry is present in the watershed, but its configuration and proximity to the East Branch Soquel Creek appears to place the stream channel at risk for major sediment input if containment devices should fail.

Limiting Condition, Lifestages, and Habitats

Threat and condition analysis within the CAP workbook indicates all lifestages are impaired in the Soquel Creek watershed with summer rearing being the most stressed. Water quantity is the most significant limiting habitat attribute, and residential development (both existing and future development) and associated impacts to instream habitat quality are the most significant threats into the future.

General Recovery Strategy

Minimize Diversions and Diversion Effects

Diversions, from direct diversions and near stream wells, adversely impact the summer rearing steelhead lifestage and are the most significant threat to steelhead in the watershed. Water diversions and pumping of the alluvial aquifer reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat.

The Soquel Creek watershed is adjudicated; however, there is no watermaster appointed to monitor flows in the watershed or other conditions of the adjudication. The lack of oversight places the fishery at even greater risk in this highly impaired watershed. To reduce the amount of water diverted from the stream and pumped from the alluvial groundwater basin, and potentially maintain summer and fall instream flows, domestic water conservation strategies should be implemented. Efforts to address the adverse impacts of water diversions could include increased oversight by the SWRCB (and County of Santa Cruz for groundwater wells) for permitted diversions and enforcement of applicable laws for unpermitted diversions. Appointment of a water master with authority to enforce the terms of the adjudication is

essential for the ensuring the long term viability of steelhead in the watershed. Additional practices could include developing channel storage facilities to divert water during the winter high flow period in exchange for leaving water instream during the summer low flow period. Conjunctive use efforts that may include water transfers and developing additional water infrastructure, such as desalination and off channel storage, should also be explored and implemented where feasible. Efforts to coordinate diversion timing and water sharing through conjunctive use agreements could also be developed to minimize impacts.

Improve Instream Habitat Quality and Quantity

Returning riparian corridors to properly functioning condition alone is unlikely to solve the poor instream habitat conditions prevalent throughout much of the watershed in a timely manner. While improved riparian function will increase wood recruitment into streams, further restoration measures will be required to fix degraded instream conditions. Recovery actions should focus on improving spawning habitat by placing standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective and directly beneficial timber harvest plan mitigation.

Based on previous stream surveys, a lack of available winter and summer habitat was identified as a factor limiting steelhead population. Winter habitat has been degraded due, in part, from a lack of LWD, which provides important slower-water refuge areas during high flow events. Summer rearing habitat has been degraded by a lack of LWD, which helps to form pools where steelhead can over-summer and provides cover and protection from predators.

LWD projects to enhance instream habitat should be implemented and designed to provide habitat for steelhead during winter and summer. In winter, LWD projects should provide continuous velocity refuges and facilitate scour during high flows to increase pool volume and frequency for juvenile salmonids, while LWD projects for summer habitat should be designed to provide cover from predators. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated, by a qualified hydrologist working in conjunction with a qualified fisheries biologist, to threaten adjacent infrastructure. Actions to restore natural processes of LWD recruitment, storage, and transport should be encouraged and implemented were feasible.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a common problem throughout the watershed. Restoration actions should focus on identifying and prioritizing current sediment sources within the basin. High-priority sites should receive initial restoration funding. The watershed is located in an area of rapid uplift, deep valleys, and seismic activity in relatively weak rock (SCCRCD 2003), which means that landslides and other forms of mass wasting are frequent occurrences. Areas identified as shallow or deep-seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads and housing should be carefully evaluated for their potential to contribute to further erosion following major rainfall events, flooding, or earthquakes.

Floodplain

A lack of available winter refuge habitat, in part from lack of access to inundated floodplain or off-channel habitats is likely a limiting factor for steelhead in Soquel Creek. The lower mainstem Soquel Creek may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. These areas are largely lost due to past agricultural, rural residential and urban encroachment. Mainstem channel and low gradient stream reaches in the tributaries should be assessed to target opportunities to restore floodplain connectivity. Floodplains may also be disconnected due to channel entrenchment. Efforts to address entrenchment, particularly in areas where relict side channels exist could, if properly implemented, appreciably increase juvenile steelhead winter survival. Restoring these existing areas may disproportionately benefit the population by providing key winter refuge habitats. Existing areas should be targeted for conservation easement(s), purchase of fee title(s), or establishment of a conservation bank(s).

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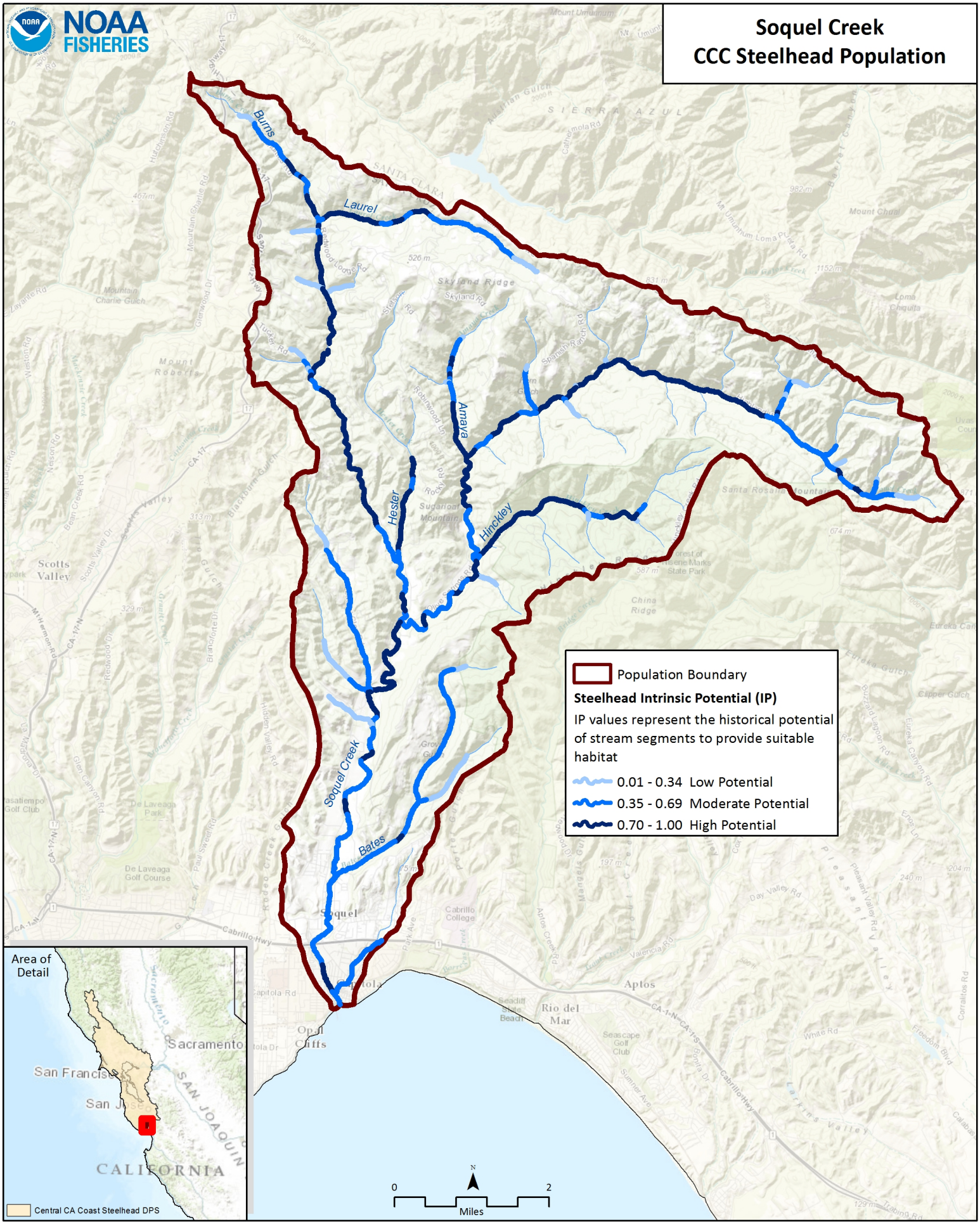
Soquel Creek
CCC Steelhead Population
NOAA FISHERIES
Burns
Laurel
Amaya
Hester
Hinckley
Soquel Creek
Bates
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Sacramento
San Francisco
San Jose
CALIFORNIA
Central CA Coast Steelhead DPS
0
2
Miles
N

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>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)	29% streams/ 10% 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 25	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	95.2% 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		
			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	?80% Density rating "D" across IP-km	Good

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	50% of IP-km to 74% of IP-km	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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 >75	Poor
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>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)	29% streams/ 26% IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	29% streams/ 72% 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)	29% streams/ 10% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	0% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score >75	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	>5 Diversions/10 IP km	Poor
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	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	95.2% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	100% streams/ 100% IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	29% streams/ 26% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	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	0.7 - 1.5 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<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)	29% streams/ 10% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	95.2% 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		
			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	?80% Density rating "D" across IP-km	Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	29% streams/ 26% 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		
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	>5 Diversions/10 IP km	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 33	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	1.3% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	7% 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	59% of watershed >1 unit/20 acres	Poor
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	4.1 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	4.0 Miles/Square Mile	Poor

Soquel Creek CAP Threat Results

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

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-1.1.1	Recovery Action	Estuary	Reduce toxicity and pollutants										
SqC-CCCS-1.1.1.1	Action Step	Estuary	Re-direct storm drains away from Soquel lagoon during summer.	3	100	City of Capitola						TBD	Cost based on number of storm drains to re-direct. Cost likely absorbed into City/County Public Works Department operations.
SqC-CCCS-1.1.1.2	Action Step	Estuary	Screen the railroad trestle to discourage roosting and nesting by rock doves.	3	10	CDFW, City of Capitola, RWQCB						TBD	Cost to screen the railroad trestle not likely to be significant.
SqC-CCCS-1.1.1.3	Action Step	Estuary	Sediment and grease traps leading into lower Soquel Creek should be annually inspected and cleaned.	3	100	City of Capitola, RWQCB, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-1.1.1.4	Action Step	Estuary	Encourage repaving and application of petrochemicals in the early summer to allow penetration and drying before fall rains.	3	100	CalTrans, City of Capitola, County of Santa Cruz Department of Public Works						0	Action is considered In-Kind
SqC-CCCS-1.1.2	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										
SqC-CCCS-1.1.2.1	Action Step	Estuary	Ensure flume is properly maintained throughout the summer low flow season.	3	100	CDFW, City of Capitola						0	Action is considered In-Kind
SqC-CCCS-1.1.2.2	Action Step	Estuary	Secure flume boards at all times to prevent their removal by vandals or bay back-flushing.	1	100	City of Capitola						0	Action is considered In-Kind
SqC-CCCS-1.1.2.3	Action Step	Estuary	Upgrade flume to ensure longevity.	2	10	CDFW, City of Capitola	50.00	50.00				100	
SqC-CCCS-1.1.2.4	Action Step	Estuary	Maximize lagoon depth throughout the summer season.	2	100	City of Capitola						0	This is an ongoing program conducted by the City of Capitola. The monitoring program that is a required part of this project also needs to continue into the future as long as the lagoon is managed during the summer period. Action is considered In-Kind
SqC-CCCS-1.1.3	Recovery Action	Estuary	Reduce adverse impacts associated with exotic and pest species.										
SqC-CCCS-1.1.3.1	Action Step	Estuary	Continue to use gull-proof lids on refuse cans at and around the lagoon and beach.	3	100	City of Capitola						0	Action is considered In-Kind
SqC-CCCS-1.1.3.2	Action Step	Estuary	Install bird deterrents on Esplanade roofs to deter gulls and other sea birds.	3	100	City of Capitola						TBD	Cost based on amount of roofs needing to be treated. Cost for bird deterrents estimated at $25/ft.
SqC-CCCS-1.1.4	Recovery Action	Estuary	Improve the quality of the estuarine habitat zones										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-1.1.4.1	Action Step	Estuary	Remove and replace exotic tree and understory species in the stream reaches above the lagoon.	3	10	City of Capitola, IWRP, County of Santa Cruz	41.00	41.00				82	Residents on the eastern margin have expressed concerns over attempts to re-establish riparian trees due to negative attitudes towards anything that might obstruct their views of the lagoon or Monterey Bay. Ongoing education and monitoring would be needed to successfully implement this recommendation. Cost based on treating 1 acre (assume 5% high IP) at a rate of $41,000. Cost to replace accounted for in below action steps.
SqC-CCCS-1.1.4.2	Action Step	Estuary	Maintain existing pilings along the eastern margin downstream of Stockton Avenue Bridge where restaurants are still on pilings.	2	100	CA Coastal Commission, CDFW, City of Capitola, County of Santa Cruz, USACE						0	This area provides backwater and overwintering shelter for fish during winter stormflows and provides summer rearing and shelter. This is the only backwater habitat in the lower estuary and should be protected from further development. Action is considered In-Kind
SqC-CCCS-1.1.4.3	Action Step	Estuary	Plant tules in the Soquel Creek estuary.	3	5	CDFW, City of Capitola, IWRP, Santa Cruz RCD	5.00					5	Tules could be planted in the cove on the east side of the estuary, downstream of the Stockton Avenue Bridge and in the cove on the eastern margin under the railroad trestle to enhance summer fishery habitat.
SqC-CCCS-1.1.5	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
SqC-CCCS-1.1.5.1	Action Step	Estuary	Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.	3	10	CA Coastal Commission, CDFW, City of Capitola, IWRP, Santa Cruz RCD	141.00	141.00				282	Costs may vary depending on the total number of structures and necessary engineering. Permitting costs are anticipated to be negligible to likely use of programmatic permits. The most appropriate location is likely near the railroad trestle under overhanging trees on the west side. The trestle may retain more saline water from tidal influxes. Any scour objects must be positioned so as not to undermine existing bulkheads or collect floating debris. Evaluate the installation of a series of J-hook vanes. The goals should be to scour two holes with dimensions at least six to ten feet wide, 30-40 feet long and four to six feet deeper than the present bed elevation. Cost for treating 1 acre (assume 10% of total estuarine habitat) at a rate of $281,099/acre.
SqC-CCCS-1.1.5.2	Action Step	Estuary	Allow large instream wood to remain in the lagoon/estuary as potential scour objects and fish cover, unless it is jammed on the Stockton Avenue Bridge.	2	100	CDFW, City of Capitola, County of Santa Cruz, USACE						0	Action is considered In-Kind
SqC-CCCS-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.	2	20	CDFW, City of Capitola, FEMA, NMFS, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD	300	300	300	300		1,500	Cost based on treating 5 miles (assume 1 project/mile) at a rate of $300,000/project.
SqC-CCCS-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	CDFW, City of Capitola, FEMA, NMFS, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD						0	A lack of available winter refuge habitat, in part from lack of access to inundated floodplain or off-channel habitats is likely a limiting factor for salmonids in Soquel Creek. The lower mainstem Soquel Creek may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. These areas are largely lost due to past agricultural practices, rural residential and urban encroachment. Efforts should be made to assess the mainstem channel and low gradient stream reaches in tributaries to target opportunities to restore floodplain connectivity. Restoring these existing areas could disproportionately benefit the salmonid populations by providing key winter refuge habitats. Costs will vary depending on site specific conditions and degree of landowner participation. Some of these areas have urban infrastructure which increases the importance of those remaining floodplain areas in Soquel. Cost accounted for in other action steps.
SqC-CCCS-2.1.2	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
SqC-CCCS-2.1.2.1	Action Step	Floodplain Connectivity	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	2	50	County of Santa Cruz, County of Santa Cruz Land Trust						TBD	The floodplain limitations currently present in the Soquel watershed are primarily due to urbanization and existing roads. The associated effects of these landuse practices to channel confinement have resulted in riparian encroachment, channel degradation, and floodplain/stream channel disconnection. FEMA flood zone maps show significant overlap of areas designated as 100-year flood prone zones and areas with high housing and commercial density. Due to the high amount of development in these areas the overall degraded condition of important floodplain habitat is expected to persist and likely worsen in the future. Cost is variable and driven by fair market value, land turnover rates, and amount of habitat needed to be restored.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-2.1.2.2	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	30	CalFire, CDFW, City of Capitola, IWRP, Redwood Empire, Santa Cruz RCD, Soquel Demonstration State Forest						0	Cost accounted for in ROADS/RAILROADS.
SqC-CCCS-2.1.2.3	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	5	California Coastal Conservancy, Santa Cruz RCD	50.00					50	Most of this data may be available from existing watershed assessments and GIS. Initial focus should be directed towards stream reaches with high IP scores.
SqC-CCCS-2.1.2.4	Action Step	Floodplain Connectivity	Review Residential and Commercial Development strategies for additional recommendations.	3	100							0	Action is considered In-Kind
SqC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
SqC-CCCS-3.1.1.1	Action Step	Hydrology	Improve survival at all life stages by restoring the historical spatial and temporal pattern of surface flows throughout spawning, rearing, and migration areas.	2	25	CDFW, IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, Trout Unlimited	15.00	15.00	15.00	15.00	15.00	75	Cost based on hydrologic model estimated at$74,195/project.
SqC-CCCS-3.1.1.2	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	25	CDFW, IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, Trout Unlimited						0	Action is considered In-Kind
SqC-CCCS-3.1.1.3	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	2	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD						TBD	
SqC-CCCS-3.1.1.4	Action Step	Hydrology	Promote off-channel storage and conservation measures to reduce impacts of summer and early fall water diversions (e.g. storage tanks for rural residential users).	2	30	CDFW, IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, Trout Unlimited						TBD	Costs are difficult to predict due to uncertainties regarding landowner participation.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-3.1.1.5	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707.	1	20	CDFW, County of Santa Cruz, Soquel Creek Water District, SWRCB, Trout Unlimited						TBD	Cost based on amount of incentives for water rights holders. Currently, incentive programs exist and should be explored for future development/expansion. Cost for water lease estimated at $177/acre ft./yr.
SqC-CCCS-3.1.1.6	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore salmonid habitat.	1	20	City of Capitola, County of Santa Cruz, Soquel Creek Water District, SWRCB						TBD	Conjunctive water use involves utilization of multiple water sources, usually both surface and groundwater sources, in a way that maximizes water storage and availability under different climatic conditions. One of the guiding goals of a conjunctive water effort is to ensure increased summer stream flows for fish habitat.
SqC-CCCS-3.1.1.7	Action Step	Hydrology	See Water Diversions and Impoundments and Severe Weather strategies for Additional Recommendations.										
SqC-CCCS-3.2	Objective	Hydrology	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-3.2.1	Recovery Action	Hydrology	Improve flow conditions										
SqC-CCCS-3.2.1.1	Action Step	Hydrology	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential salmonid.	3	10							0	Cost accounted for in action step above.
SqC-CCCS-3.2.1.2	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	2	100	CDFW, NMFS, NMFS OLE, Public, SWRCB						0	Priority areas should include the lower mainstem areas and stream reaches with IP-km scores above 0.7. Significant portions of the available water supply for domestic consumption originates from wells which likely influence available surface water flows in Soquel Creek. Action is considered In-Kind
SqC-CCCS-5.1	Objective	Passage	Address other natural or manmade factors affecting the species continued existence										
SqC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
SqC-CCCS-5.1.1.1	Action Step	Passage	Evaluate the two natural falls at the Girl Scout Camp on West Branch Soquel and determine the benefits of providing passage for steelhead into upper reaches.	2	10	CDFW, IWRP, NMFS, Santa Cruz RCD	148.50	148.50				297	If modification is feasible (this recommendation may conflict with some existing policies) the benefits of the upstream habitat should be accessed. Areas where there is less disturbance and a greater probability of spawning and rearing success, should be carefully considered in light of the status of the species in the Santa Cruz Mountains Diversity Stratum. The West Branch reach above Girl Scout Falls II has 3-4 miles of low gradient potential steelhead habitat. Cost estimate is for evaluation only. Cost based on treating two natural falls at a rate of $148,194/unit. Cost could be lower if minimal modifications are needed.
SqC-CCCS-5.1.1.2	Action Step	Passage	Evaluate the Soquel Creek Water District Weir for potential impacts to steelhead migration on East Branch Soquel.	2	5	CDFW, Soquel Creek Water District	42.00					42	Cost based on escapement monitoring estimated at $41,472/project.
SqC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Identify historical steelhead habitats lacking in channel complexity and initiate restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	10	CDFW, City of Capitola, Private Landowners, Public, County of Santa Cruz, Santa Cruz RCD	65.50	65.50				131	Restoration actions in Soquel Creek would likely benefit from an updated habitat typing effort. However, restoration should not be delayed while awaiting results from habitat typing. Areas of high potential include the lower mainstem from Bates Creek confluence to Moores Gulch Confluence, the lower mainstem from Nob Hill to Soquel Drive Bridge, and East Branch Soquel Creek. The mainstem locations should be assessed for current complexity. Cost for fish/habitat monitoring estimated at $130,941/project.
SqC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	City of Capitola, IWRP, NRCS, Private Landowners, Redwood Empire, County of Santa Cruz Land Trust, Santa Cruz RCD, State Parks	324.00	324.00				648	Cost based on treating 22 miles of stream at a rate of $29,440/mile. Due to the extensive amount of infrastructure in some reaches and development in the lower watershed it is likely that the majority of structures will need to be anchored. Unanchored and properly sized large wood structures could likely be installed in upper East Branch Soquel Creek. Anchored wood will likely be necessary in the upper mainstem above Moore's Gulch. Transport of large woody material to downstream reaches is less likely due to extensive channel meanders in these areas. Prior to installation, instream conditions should be carefully assessed for effectiveness in Bates Creek, Hinckley Creek, Amaya Creek, and Hester Creek. SDSF has undertaken a LWD project in the East Branch SC including the use of whole trees. Costs for implementing these projects may be more than estimated depending on the methods used.
SqC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Continue with implementation of additional LWD projects in Soquel Demonstration State Forest to demonstrate their effectiveness to residents of the County of Santa Cruz and region.	1	10	CalFire, CDFW, IWRP, NOAA SWFSC, County of Santa Cruz, Santa Cruz RCD, Soquel Demonstration State Forest						0	Cost accounted for in above action steps. Effectiveness should evaluate the biological response of salmonids to LWD supplementation as well as fate of the structures over time.

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SqC-CCCS-6.1.1.4	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	10	IWRP, Public, County of Santa Cruz, Santa Cruz RCD						0	Initial efforts should be directed at landowners in the reach near the West Branch and East Branch confluence and then expanded to other areas. Large wood is reportedly removed in these stream reaches. Loss of wood in these reaches adversely affects downstream pool formation. County of Santa Cruz implemented a large wood evaluation program in 2009. The program has been largely successful. Additional outreach and education are needed with private landowners in Soquel watershed. Many streamside landowners cut up the large wood material without regulatory permits. These unsanctioned actions have resulted in a significant diminishment of rearing habitat quality. Education programs could consist of fliers, workshops, public service announcements, etc. Action is considered In-Kind
SqC-CCCS-6.1.1.5	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	California Coastal Conservancy, CDFW, NOAA RC, Private Landowners, RWQCB, San Mateo RCD, Soquel Demonstration State Forest, State Parks, USACE						0	Action is considered In-Kind
SqC-CCCS-6.1.1.6	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	2	100	CDFW, City of Capitola, FEMA, County of Santa Cruz, Soquel Demonstration State Forest, USACE						0	Action is considered In-Kind
SqC-CCCS-6.1.1.7	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical steelhead rearing habitats in Soquel Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CalFire, California Coastal Conservancy, CDFW, NOAA RC, County of Santa Cruz, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						0	Manipulation of LWD should not occur until evaluated by the County of Santa Cruz Planning staff and hydrologist and/or qualified biologist familiar with Central Coast streams. Action is considered In-Kind

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SqC-CCCS-6.1.1.8	Action Step	Habitat Complexity	Conserve and manage forestlands for older forest stages.	3	100	CalFire, County of Santa Cruz, Private Landowners, RWQCB, Soquel Demonstration State Forest						0	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Conifer release is more likely to be implemented on landscapes where timber management is the primary landuse. Efforts should be made to encourage this practice with rural residential landowners. Action is considered In-Kind
SqC-CCCS-6.1.1.9	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	Big Creek Lumber, County of Santa Cruz, Private Landowners, Soquel Demonstration State Forest	181.00	181.00				362	Cost based on treating 2.7 miles (assume 1 project/mile in 15% high IP) at a rate of $1673/acre.
SqC-CCCS-6.1.1.10	Action Step	Habitat Complexity	Prepare general press releases and outreach information explaining benefit of large wood that can quickly be sent out to media outlets and property owners after a large storm event.	2		CalFire, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Improve shelter										
SqC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Increase shelters to optimal conditions (>80 pool shelter value) in mainstem Soquel Creek.	2	20	CDFW, City of Capitola, IWRP, NMFS, NRCS, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, Soquel Demonstration State Forest						TBD	An increase in shelter would largely occur as a consequence of other instream enhancement actions.
SqC-CCCS-6.1.3	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
SqC-CCCS-6.1.3.1	Action Step	Habitat Complexity	Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams).	2	10	CDFW, City of Capitola, IWRP, NMFS, NRCS, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, Soquel Demonstration State Forest	29.50	29.50				59	The most appropriate technique to increase pool frequency in Soquel Creek will likely involve installation of large woody material. Other instream habitat elements could include boulder installation into responsive stream reaches. Cost based on treating 2 miles of stream at a rate of $29,440/mile for LWD placement. If constructing ELJ, assume 10/mile at a rate of 115,276/ELJ for a total of 2,305,000.
SqC-CCCS-6.1.4	Recovery Action	Habitat Complexity	Increase frequency of primary pools										

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SqC-CCCS-6.1.4.1	Action Step	Habitat Complexity	Excavate sediment and build up channel bars.	2	10	CalFire, IWRP, NRCS, County of Santa Cruz, Santa Cruz RCD	37.50	37.50				75	Using an excavator/backhoe, remove sediment from incipient pools or adjacent to incipient bars, and place the sediment on incipient bars. Grade the placed sediment to contoured form and attach to banks, mimicking alternate bars in general shapes. Bars should confine the active channel approximately 50% in width. This rough design estimate should be refined by results from field survey and hydraulic model analysis. Place LWD and available coarse sediment on bar surfaces to increase resistance to erosion.
SqC-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
SqC-CCCS-8.1.1.1	Action Step	Sediment	Improve habitat conditions at multiple life stages by reducing sediment inputs to the stream at the watershed scale.	3	25	CalFire, IWRP, NRCS, County of Santa Cruz, Santa Cruz RCD						0	Cost accounted for in other action steps.
SqC-CCCS-8.1.1.2	Action Step	Sediment	Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.	3	10	CalFire, IWRP, NRCS, County of Santa Cruz, Santa Cruz RCD	48.50	48.50				97	Cost for erosion assessment estimated at $14.35/acre (assume 25% of total watershed acres).
SqC-CCCS-8.1.1.3	Action Step	Sediment	Remediate slides and gullies delivering sediment to fish bearing streams.	3	30	IWRP, NRCS, County of Santa Cruz, Santa Cruz RCD						TBD	The ultimate causes of slope and stream bank instability should be addressed where practicable and financially feasible. In some circumstances remediation in the Soquel Creek watershed may not be practicable due to geologic constraints and instability in some stream reaches. Stabilization techniques should involve appropriate bioengineering practices as the first priority. Areas of high interest include a large older landslide upstream of Girl Scott Falls II and the Highland Way Slide on East Branch Soquel Creek. Protection of streambanks below unconsolidated deposits of large rotation landslides should be considered priorities for threat abatement and restoration.
SqC-CCCS-8.1.1.4	Action Step	Sediment	Initiate education program for landowners in the watershed regarding practices to minimize sediment input.	3	10	City of Capitola, IWRP, NRCS, County of Santa Cruz, Santa Cruz RCD	10.00	10.00				20	Existing material could be used rather than tailoring an education program to constraints and issues within Soquel Creek. Education should be ongoing with frequent workshops (yearly).

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SqC-CCCS-8.1.1.5	Action Step	Sediment	Improve enforcement of Erosion Control Ordinance for private roads.	2	10	County of Santa Cruz	250.00	250.00				500	Cost likely amounts to a 1/2 time position in the Soquel Creek/Aptos Creek watersheds. Costs were estimated over a ten year interval and will likely need further refinement if this recommendation is carried out over a longer duration. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.
SqC-CCCS-8.1.1.6	Action Step	Sediment	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	1	100	CalFire, CDFW, NRCS, County of Santa Cruz, Santa Cruz RCD, USACE						0	This should be considered a standard business practice for all permitting agencies. Action is considered In-Kind
SqC-CCCS-8.1.1.7	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	25							0	Action is considered In-Kind
SqC-CCCS-8.1.1.8	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	CalFire, CalTrans, NRCS, County of Santa Cruz Department of Public Works, Santa Cruz RCD	10.00	10.00	10.00	10.00		40	This cost estimate does not include long-term maintenance obligations.
SqC-CCCS-8.1.1.9	Action Step	Sediment	Location for long-term sediment spoil sites should be identified and developed.	3	10	CalTrans, City of Capitola, County of Santa Cruz, NRCS, RWQCB						TBD	A significant amount of sediment is removed from inside ditches and road surfaces during winter months due to general erosion and removal of landslides and is temporarily deposited in areas with hydraulic connectivity to watercourses.
SqC-CCCS-8.1.1.10	Action Step	Sediment	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	50	County, FEMA, NMFS						0	Action is considered In-Kind
SqC-CCCS-8.1.1.11	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	1	100	CalFire, City of Capitola, County of Santa Cruz						0	Stream reaches with a total of 1.5 to 2 bankfull widths (on both banks) of healthy native riparian vegetation offer the best instream habitat and have the most stable banks (Balance Hydrologics 1998). Action is considered In-Kind
SqC-CCCS-8.1.1.12	Action Step	Sediment	Assess landslide stabilization and sediment source reduction.	3	5	Santa Cruz RCD						TBD	Initial efforts should begin in Amaya Creek followed by West Branch Soquel and Bates Creeks. Many portions of Soquel Creek are seismically active and stabilizing landslide may prove infeasible. Cost accounted for in erosion assessment.
SqC-CCCS-8.1.1.13	Action Step	Sediment	Review strategies under Roads and Railroads, Recreation, and Logging for recovery recommendations.									0	
SqC-CCCS-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										

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SqC-CCCS-11.1.1.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	3	100	CDFW, NOAA SWFSC, Soquel Water District						0	Periodic surveys (redd surveys may be the most viable survey method in Soquel) are likely the preferred alternative in Soquel (a Dependent watershed) due to the other adult monitoring all ready occurring in other Dependent watersheds in the Santa Cruz Mtn. Diversity Stratum. Cost accounted for in Monitoring Chapter.
SqC-CCCS-11.1.1.2	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.	2	100	CalFire, CDFW, County of Santa Cruz, NMFS, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						TBD	Existing CDFW habitat survey protocols may be utilized at little or no cost for development. Other efforts should include temperature monitoring and an effort to evaluate the rate of large wood recruitment and retention into Soquel Creek.
SqC-CCCS-11.1.1.3	Action Step	Viability	Implement a long term study project in Soquel Demonstration State Forest to demonstrate effective LWD projects to the residents of the Santa Cruz Mountains.	1	10	NOAA SWFSC, Soquel Demonstration State Forest	100.00	100.00	100.00			300	Long - term monitoring should include monitoring of juvenile salmonid response to LWD supplementation.
SqC-CCCS-12.1	Objective	Agriculture	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-12.1.1	Recovery Action	Agriculture	Prevent or minimize increased landscape disturbance										
SqC-CCCS-12.1.1.1	Action Step	Agriculture	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.	1	100	CalFire, FEMA, County of Santa Cruz, County of Santa Cruz Land Trust, The Nature Conservancy						0	Action is considered In-Kind
SqC-CCCS-13.1	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-13.1.1	Recovery Action	Channel Modification	Prevent or minimize impairment of floodplain connectivity (impaired quality and extent)										
SqC-CCCS-13.1.1.1	Action Step	Channel Modification	For riparian roads, promote road relocation as a preferred alternative to bank stabilization.	2	100	CalFire, CalTrans, CDFW, City of Capitola, FEMA, NRCS, County of Santa Cruz, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks, USACE						0	Road relocation should be carefully and thoughtfully evaluated as an alternative to bank hardening prior to designing new bank stabilization measures. Road relocation in some circumstances can result in long term cost savings and significant fisheries benefits. Action is considered In-Kind
SqC-CCCS-13.1.2	Recovery Action	Channel Modification	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										

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SqC-CCCS-13.1.2.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	100	CalFire, CalTrans, City of Capitola, FEMA, NRCS, County of Santa Cruz, Santa Cruz RCD, USACE						0	This should be considered a standard practice for all individuals, agencies, and companies engaged in instream work. The Soquel watershed consists of three distinctive geologic blocks separated by the San Andreas and Zayante fault zones (SCCRCD 2003). The distribution and activity of the major fault zones has contributed to a large number of landslides, which have periodically dumped large quantities of sediment to the watercourse. Additionally, shorts periods of net sediment aggradation within the stream channel have been documented following major floods (SCCRCD 2003). In reaction to large sediment input events, there is a potential for future bank destabilization due to bed aggradation as pulses of sediment move through the system. Action is considered In-Kind
SqC-CCCS-13.2	Objective	Channel Modification	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-13.2.1	Recovery Action	Channel Modification	Prevent or minimize impairment of floodplain connectivity (impaired quality and extent)										
SqC-CCCS-13.2.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	CalFire, CalTrans, City of Capitola, FEMA, NRCS, County of Santa Cruz Department of Public Works, Santa Cruz RCD, Soquel Demonstration State Forest, USACE						0	Adoption of this standard practice will result in increased costs for some projects but will ultimately result in long term savings due to better designed and constructed projects with long term persistence. Action is considered In-Kind
SqC-CCCS-13.2.1.2	Action Step	Channel Modification	Avoid or minimize the effects of channelization projects on steelhead habitat.	1	100	CDFW, FEMA, NRCS, County of Santa Cruz, USACE						0	Action is considered In-Kind
SqC-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 historical CCC steelhead watersheds.	2	10	CalTrans, City of Capitola, FEMA, NMFS, County of Santa Cruz, USACE						0	Action is considered In-Kind
SqC-CCCS-15.1	Objective	Fire/Fuel Management	Address other natural or manmade factors affecting the species continued existence										
SqC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
SqC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.	3	10	CalFire, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind

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SqC-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	Disseminate plan to all local firefighting agencies.	3	10	CalFire, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-15.1.1.3	Action Step	Fire/Fuel Management	Disseminate recommendations from NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local fire fighting agencies and CalFire.	3	25	CalFire, Local, NMFS						0	
SqC-CCCS-15.1.1.4	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the Soquel Creek watershed (and all other watersheds in the County).	3	10	CalFire, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-15.1.1.5	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	2	100	CalFire, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-15.1.1.6	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	3	50	CalFire, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-15.1.1.7	Action Step	Fire/Fuel Management	Reassess fire risk every ten years.	3	100	CalFire, County of Santa Cruz						0	This should be a standard practice. Action is considered In-Kind
SqC-CCCS-15.1.1.8	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	60	CalFire, County of Santa Cruz, Private Landowners, Public						0	Action is considered In-Kind
SqC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SqC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	1	100	CalFire, County of Santa Cruz						0	Sediment control is a requirement for all post firefighting actions. Immediately implementing these measures (when feasible) when equipment and crews are available will minimize mobilization costs and result in a long term cost savings. Action is considered In-Kind
SqC-CCCS-15.1.2.2	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas.	2	100	CalFire						0	Action is considered In-Kind
SqC-CCCS-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
SqC-CCCS-15.1.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	3	10	CalFire, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-15.1.4	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SqC-CCCS-15.1.4.1	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	100	CalFire, CDFW, NMFS, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-15.2	Objective	Fire/Fuel Management	Address the inadequacy of existing regulatory mechanisms										

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SqC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SqC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire						0	Action is considered In-Kind
SqC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFW, NMFS, County of Santa Cruz, Santa Cruz RCD, USEPA, USFWS						0	The resource agencies can provide guidance regarding critical resources in the areas that may be impacted by firefighting actions. Action is considered In-Kind
SqC-CCCS-16.1	Objective	Fishing/Collecting	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity										
SqC-CCCS-16.1.1.1	Action Step	Fishing/Collecting	Reduce poaching of adult steelhead by increasing law enforcement.	1	100	CDFW Law Enforcement, NMFS OLE						0	Initial focus should be directed towards the East Branch of Soquel Creek where steelhead juveniles were detected in 2008. Action is considered In-Kind
SqC-CCCS-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFW to modify the low flow minimum flow closure in Title 14, Section 8.00(b)(1) of the California Code of Regulations to include Soquel Creek.	2	5	CDFW, NMFS, Public						0	Low flow closures are needed for Soquel Creek and should be based on flow gage information from a local watershed. Action is considered In-Kind
SqC-CCCS-16.1.1.3	Action Step	Fishing/Collecting	Work with California Fish and Game Commission to modify the dates of fishing season to be to at least January 15. Consideration should be given to pushing the entire fishing season back so that the total number of fishing days is not reduced significantly.	2	5	California Fish and Game Commission, NMFS, Public						0	Action is considered In-Kind
SqC-CCCS-16.1.1.4	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along Soquel Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	2	5	CDFW, CDFW Law Enforcement, NMFS OLE	7.50					8	Cost for signs vary widely depending on materials and content. Assume $500/sign with a minimum of 15 signs.
SqC-CCCS-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SqC-CCCS-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	1	100	CalFire, CDFW, RPFs, RWQCB						0	Action is considered In-Kind
SqC-CCCS-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SqC-CCCS-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	2	100	CalFire, CDFW, RPFs, County of Santa Cruz, SWRCB						0	Action is considered In-Kind

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
SqC-CCCS-19.1.3.1	Action Step	Logging	Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	3	100	CalFire, Private Landowners, Redwood Empire, RPFs, Soquel Demonstration State Forest						0	The current Forest Practices Rules require retention of a proportion of the largest riparian trees. Action is considered In-Kind
SqC-CCCS-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, CDFW, County of Santa Cruz, Soquel Demonstration State Forest, State Parks	134.00	134.00				268	Costs will vary depending on landowner participation and site specific needs. This strategy can be implemented at relatively little costs in areas zoned for timber production as a component of future harvest plans. Cost based on treating 2 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,674/acre.
SqC-CCCS-19.1.4	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SqC-CCCS-19.1.4.1	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Private Landowners, Redwood Forest Foundation, RPFs, Soquel Demonstration State Forest						0	Action is considered In-Kind
SqC-CCCS-19.1.4.2	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire, CDFW, Private Landowners, Redwood Empire, RPFs, County of Santa Cruz, Soquel Demonstration State Forest						0	This recommendation should be considered standard practice. Action is considered In-Kind
SqC-CCCS-19.1.4.3	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, RWQCB, Soquel Demonstration State Forest						0	Action is considered In-Kind
SqC-CCCS-19.1.4.4	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, RPFs, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-19.1.5	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFW, Private Landowners, Public, Redwood Empire, RPFs, County of Santa Cruz, Soquel Demonstration State Forest, State Parks						0	Cost of managing riparian areas is anticipated to be minimal. Action is considered In-Kind
SqC-CCCS-19.1.6	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
SqC-CCCS-19.1.6.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, Soquel Demonstration State Forest						0	Logging was identified as a potential future threat to summer rearing juveniles due to the potential of timber management to reduce future LWD recruitment and increase instream temperatures. California Forest Practice Rules require retention of riparian trees adjacent to Class 1 fish-bearing streams, which will ameliorate the impacts of reduced LWD and over story canopy reduction (Santa Cruz County rules do not allow even-aged management). Despite these restrictions it is likely future timber management may reduce or delay the rate of future recruitment by harvesting trees that could potentially be recruited into the stream channel. This impact could be partially offset if, mitigation measures for future timber harvest plans, included a large wood augmentation program. An augmentation program would need to include an evaluation of limiting factors, including riparian canopy cover and instream temperature regimes. Action is considered In-Kind
SqC-CCCS-19.1.6.2	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc).	2	25	CalFire, CDFW, RPFs, RWQCB, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-19.1.6.3	Action Step	Logging	Encourage landowners to implement restoration projects as part of their ongoing practices in priority stream reaches, particularly where large woody debris is found lacking.	2	100	CalFire, CDFW, County of Santa Cruz, Soquel Demonstration State Forest						0	This is an ongoing effort that should be encourage for every THP in the Soquel watershed. Particular focus should be directed at THPs directly adjacent to Class 1 streams. Action is considered In-Kind
SqC-CCCS-19.1.7	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SqC-CCCS-19.1.7.1	Action Step	Logging	To the maximum extent practicable, all roads, landings, and skid trails associated with timber operations should be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, RWQCB, County of Santa Cruz, Soquel Demonstration State Forest						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-CCCS-19.1.7.2	Action Step	Logging	Minimize new road construction in riparian zones (< 100 feet).	1	100	CalFire, CDFW, NMFS, RPFs, RWQCB, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-19.1.7.3	Action Step	Logging	Minimize road construction near headwater channels.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, RWQCB, County of Santa Cruz, Soquel Demonstration State Forest						0	Action is considered In-Kind
SqC-CCCS-19.1.7.4	Action Step	Logging	See Roads and Railroads for additional recommendations.										
SqC-CCCS-19.1.8	Recovery Action	Logging	Prevent or minimize impairment to water quality (impaired stream temperature)										
SqC-CCCS-19.1.8.1	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	3	100	CalFire, IWRP, Private Landowners, Redwood Empire, RPFs, RWQCB, County of Santa Cruz, Soquel Demonstration State Forest						0	Wider riparian zones are critical to maintaining water temperature in Soquel Creek. Lower Soquel is temperature impaired for CCC steelhead during the summer low flow season. However canopy, while an important determinant in water temperature conditions, is likely a secondary factor when compared to the magnitude of temperature impacts resulting from surface and ground water diversions in the watershed. Action is considered In-Kind
SqC-CCCS-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
SqC-CCCS-19.2.1.2	Action Step	Logging	Encourage a watershed-wide HCP/GCP/Natural Community Conservation Plan or other procedures for multiple forest landowners within the Soquel Creek watershed to pool resources as a means to facilitate long-term survival and recovery for steelhead and their habitat.	3	30	CDFW, City of Capitola, NMFS, Private Landowners, County of Santa Cruz, County of Santa Cruz Land Trust, Soquel Creek Water District, Soquel Demonstration State Forest, State Parks, USFWS	200.00	200.00	200.00	200.00	200.00	1,200	The HCP should not exceed 30 years in duration and should focus on the larger landowners and water diverters. HCPs can be developed for multiple landowners engaged in multiple (otherwise legal) practices. Cost estimate is for development of the HCP. Development costs are highly variable and are contingent on proposed covered activities, regulatory agency staffing, and interpersonal dynamics during negotiations.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-19.2.1.3	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in high priority stream reaches where large woody material is deficient.	2	100	CalFire, CDFW, Private Landowners, Redwood Empire, County of Santa Cruz, Soquel Demonstration State Forest						0	Action is considered In-Kind
SqC-CCCS-19.2.1.4	Action Step	Logging	Discourage Santa Cruz County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	County of Santa Cruz						0	A significant portion of the watershed consists of small rural residential ownership parcels. Rural residential development is generally deleterious to watershed processes. Action is considered In-Kind
SqC-CCCS-19.2.1.5	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within steelhead areas.	1	20	CalFire, CDFW, NMFS, RWQCB, County of Santa Cruz						0	Initial focus should be directed towards proposed harvest plans in the East Branch of Soquel Creek. Action is considered In-Kind
SqC-CCCS-19.2.1.6	Action Step	Logging	Erosion control measures and road maintenance should be maintained during the entire period between re-entries.	2	100	CalFire, CDFW, Redwood Empire, RPFs, RWQCB						0	Action is considered In-Kind
SqC-CCCS-19.2.1.7	Action Step	Logging	Work with CalFire and the county to review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-19.2.2	Recovery Action	Logging	Prevent or minimize impairment to water quality (impaired stream temperature)										
SqC-CCCS-19.2.2.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, Private Landowners, RPFs, RWQCB						0	Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC DPS) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for steelhead rearing. Action is considered In-Kind
SqC-CCCS-20.1	Objective	Mining	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-20.1.1	Recovery Action	Mining	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SqC-CCCS-20.1.1.1	Action Step	Mining	Refine mining operations to reduce erosion and other impacts.	3	100	CDFW, State, NMFS, ACOE						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-20.1.1.2	Action Step	Mining	Monitor quarry operations to ensure compliance with County and State policies.	2	100	RWQCB, County of Santa Cruz						TBD	Mining was considered a potential future threat due to existing sediment controls potentially failing during a major storm event. Only one quarry is present in the watershed, but its configuration and proximity to the East Branch Soquel Creek appears to place the stream channel at risk for major sediment input if containment devices should fail. Particular focus should be directed at water retention facilities and check dams during periods of high rainfall to ensure proper operation and that no unauthorized occurrences of turbidity or sediment input enter fish bearing watercourses. Cost are difficult to determine because of timing and extent of occurrences of turbidity are unknown at this time.
SqC-CCCS-20.1.1.3	Action Step	Mining	Tailings, settling ponds, and other attributes of mining should be secured to ensure sediment, toxins, and other deleterious substances do not enter streams through either direct runoff or subsurface flow.	2	100	CDFW, County of Santa Cruz, RWQCB						0	This recommendation is typically a standard business practice for mining operation due to a variety of regulatory requirements. The Olive Springs Quarry should be monitored to ensure it remains in full compliance with its NPDES permit obligations. Action is considered In-Kind
SqC-CCCS-20.1.1.4	Action Step	Mining	Active and future mining areas should be located in areas where operations will not result in any changes to downstream water quality, including changes in turbidity, pH, temperature, and rate of sedimentation.	3	100	RWQCB						0	Costs of avoiding environmental impacts should be minimal with proper and conservative planning. Action is considered In-Kind
SqC-CCCS-20.1.1.5	Action Step	Mining	All abandoned mining areas should comport to the requirements of the Surface Mine Control and Reclamation Act.	3	100	California Department of Mines and Geology, RWQCB						0	This should be considered a standard business practice. A site specific evaluation is likely needed. Costs of implementing this recommendation should be borne by the quarry operator. Action is considered In-Kind
SqC-CCCS-20.1.2	Recovery Action	Mining	Prevent or minimize adverse alterations to riparian species composition and structure										
SqC-CCCS-20.1.2.1	Action Step	Mining	For all mining locations, saving topsoil preserves the natural growing medium for plants that will be used to revegetate spoils.	3	100	California Department of Mines and Geology						0	Costs should be minimal and should be part of Reclamation PlanAction is considered In-Kind
SqC-CCCS-22.1	Objective	Residential/ Commercial Development	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SqC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	Develop an incentive program for a roof runoff collection system for detaining runoff and providing for landscape irrigation.	3	10	County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District						0	Action is considered In-Kind
SqC-CCCS-22.1.1.2	Action Step	Residential/ Commercial Development	Incorporate rain harvesting, storm-water wetland catchment basins, and pervious surfaces into existing and new development.	3	100	City of Capitola, Private Landowners, County of Santa Cruz						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-22.1.1.3	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 Capitola, Private Landowners, County of Santa Cruz						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant.
SqC-CCCS-22.1.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SqC-CCCS-22.1.2.1	Action Step	Residential/ Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	City of Capitola, Private Landowners, RWQCB, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.1.2.2	Action Step	Residential/ Commercial Development	Sediment from existing and future commercial and urban/residential development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100	City of Capitola, Private Landowners, RWQCB, County of Santa Cruz						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SqC-CCCS-22.1.2.3	Action Step	Residential/ Commercial Development	Design new developments that minimize unstable slopes, and wetlands areas of high habitat value, and similarly constrained sites.	2	100	CalTrans, City of Capitola, Private Landowners, RWQCB, County of Santa Cruz						0	Stringent review by permitting agencies is expected to reduce costs associated with poorly planned and poorly located developments. Action is considered In-Kind
SqC-CCCS-22.1.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality and extent)										
SqC-CCCS-22.1.3.1	Action Step	Residential/ Commercial Development	Encourage Santa Cruz to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	3	20	FEMA, Private Landowners, County of Santa Cruz, County of Santa Cruz Land Trust						TBD	This recommendation may be difficult to implement unless Santa Cruz realizes a cost savings (due to reduced flood fighting, etc). A financial analysis will likely be needed.
SqC-CCCS-22.1.3.2	Action Step	Residential/ Commercial Development	Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channels migration zones to avert future bank erosion controls projects.	1	100	City of Capitola, FEMA, Private Landowners, Public, RWQCB, County of Santa Cruz, USACE						0	Action is considered In-Kind
SqC-CCCS-22.1.3.3	Action Step	Residential/ Commercial Development	Encourage establishment of conservation easements on floodplain habitat in key stream reaches.	2	100	CalTrans, CDFW, County of Santa Cruz Land Trust, USACE						TBD	Cost will vary depending on location and desirability of parcel for future development.
SqC-CCCS-22.1.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
SqC-CCCS-22.1.4.1	Action Step	Residential/ Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and avoid, minimize and/or mitigate their impacts to rearing and migrating CCC steelhead.	2	5	CDFW, FEMA, NMFS, County of Santa Cruz, USACE						0	The purpose of this recommendation is to ensure that any stream maintenance that continues to occur is not the result of the legacy of past management practices but is in fact occurring for a demonstrable benefit to public/private property. Actions that have no or minimal benefit to public/private property should be discontinued. Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-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.	3	100	City of Capitola, Santa Cruz RCD, Soquel Creek Water District						0	Action is considered In-Kind
SqC-CCCS-22.1.4.3	Action Step	Residential/ Commercial Development	Remove non-native riparian vegetation via thinning and removal programs.	3	20	City of Capitola, IWRP, Private Landowners, Santa Cruz RCD	204	204	204	204		818	Non native vegetation is most problematic in the urbanized lower reaches of Soquel Creek. Cost based on treating 0.25 mile (assume 80 acres/mile) at a rate of $40,879/acre.
SqC-CCCS-22.1.4.4	Action Step	Residential/ Commercial Development	Maintain current riparian buffers, and setbacks	3	100	County of Santa Cruz, FEMA						0	Action is considered In-Kind
SqC-CCCS-22.1.4.5	Action Step	Residential/ Commercial Development	Focus initial enforcement efforts on the West Branch of Soquel Creek where riparian trees and instream woods are being removed without appropriate authorization.	2	20	CDFW, County of Santa Cruz, NMFS OLE						0	Unauthorized removal of instream structure is reportedly occurring from the efforts of landowners adjacent to the West Branch of Soquel. Removal perpetuates degraded conditions. Action is considered In-Kind
SqC-CCCS-22.1.5	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance										
SqC-CCCS-22.1.5.1	Action Step	Residential/ Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.	2	100	City of Capitola, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.1.5.2	Action Step	Residential/ Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	2	100	City of Capitola, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.1.5.3	Action Step	Residential/ Commercial Development	Improve education and awareness of agencies, landowners and the public regarding salmonid protection and habitat requirements.	3	25	City of Capitola, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-22.1.5.4	Action Step	Residential/ Commercial Development	Focus education efforts through workshops, outreach to stream side landowners, and schools.	2	20	County of Santa Cruz, Santa Cruz RCD	5.00	5.00	5.00	5.00		20	Use of existing education materials should reduce overall costs.
SqC-CCCS-22.1.6	Recovery Action	Residential/ Commercial Development	Prevent or minimize reduced density, abundance, and diversity										
SqC-CCCS-22.1.6.1	Action Step	Residential/ Commercial Development	Design and implement education programs to promote public awareness of salmonid habitats within urban creek settings and life history requirements.	2	10	City of Capitola, IWRP, County of Santa Cruz, Santa Cruz RCD						0	Education programs could consist of fliers, workshops, public service announcements, etc. Some of these materials have been developed by the Santa Cruz RCD and County of Santa Cruz and should be used in initial efforts to promote public awareness. Action is considered In-Kind
SqC-CCCS-22.1.6.2	Action Step	Residential/ Commercial Development	Review Hydrology, Roads and Railroads, Water Diversion and Impoundment strategies for additional recommendations.										
SqC-CCCS-22.2	Objective	Residential/ Commercial Development	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize adverse alterations to riparian species composition and structure										
SqC-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Encourage county and city planning departments to designate special assessment districts for properties with infrastructure located in high risk flood prone zones. Revenue generated should be used to raise or relocate infrastructure away from high risk flood zones.	3	10	City of Capitola, County of Santa Cruz						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-CCCS-22.2.1.2	Action Step	Residential/ Commercial Development	Encourage Santa Cruz County to improve riparian ordinances to be more protective of watershed processes in regard to pre-existing development and allowances for riparian exemptions.	2	5	County of Santa Cruz						0	Santa Cruz County should develop incentives to promote private landowners to pull back from riparian zones. Exemption process for riparian development should be made more stringent. Action is considered In-Kind
SqC-CCCS-22.2.2	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to watershed hydrology										
SqC-CCCS-22.2.2.1	Action Step	Residential/ Commercial Development	Support the development and implementation of regulations for activities that adversely impact groundwater recharge.	2	10	County of Santa Cruz, Soquel Creek Water District						0	Action is considered In-Kind
SqC-CCCS-22.2.2.2	Action Step	Residential/ Commercial Development	New development in all historical CCC steelhead watersheds should minimize storm-water runoff, changes in duration, or magnitude of peak flow.	1	100	RWQCB, County of Santa Cruz, USACE, USEPA						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SqC-CCCS-22.2.2.3	Action Step	Residential/ Commercial Development	In rural areas, encourage and/or require on site detention and retention of spoils.	2	20	RWQCB, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-22.2.2.4	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.	1	100	County of Santa Cruz, SWRCB						0	Costs should be minimal and are considered part of SWRCB existing authority and obligation. The recommendation should be implemented every year over the 100 year planning horizon. Action is considered In-Kind
SqC-CCCS-22.2.3	Recovery Action	Residential/ Commercial Development	Prevent or minimize increased landscape disturbance										
SqC-CCCS-22.2.3.1	Action Step	Residential/ Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	100	County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.2.3.2	Action Step	Residential/ Commercial Development	Minimize rate, and subsequent adverse affects, of land conversion to residential and commercial development.	3	100	County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.2.3.3	Action Step	Residential/ Commercial Development	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	100	County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.2.3.4	Action Step	Residential/ Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-22.2.4	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality and extent)										
SqC-CCCS-22.2.4.1	Action Step	Residential/ Commercial Development	Santa Cruz County should continue policies that discourage new construction in undeveloped areas within the 100-year flood prone zones.	2	100	County of Santa Cruz						0	Remaining undeveloped floodplains provide critical high water refugia for listed salmonids. These habitats are typically converted to landuses incompatible with salmonid life history requisites. Costs should be minimal if incorporated into updated general plan. Significant cost savings would result due to avoidance of emergency response and repair on part of local, Federal, and state governments. Evaluate effectiveness of the policies and update to augment provisions as necessary in General Plan updates. Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-CCCS-22.2.4.2	Action Step	Residential/ Commercial Development	Modify all County General Plans to eliminate provisions allowing new construction in undeveloped areas within the 100-year flood prone zones in all historical CCC steelhead watersheds.	2	10	County of Santa Cruz						0	Costs should be minimal if incorporated into updated general plan. Action is considered In-Kind
SqC-CCCS-22.2.4.3	Action Step	Residential/ Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	County of Santa Cruz						0	Costs should be minimal if incorporated into updated general plan. The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection. Action is considered In-Kind
SqC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired water gravel quality and quantity)										
SqC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Department of Mines and Geology, CalTrans, CDFW, City of Capitola, NRCS, Redwood Empire, RWQCB, County of Santa Cruz, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	15	County of Santa Cruz, IWRP, Santa Cruz RCD						TBD	Plan should establish areas for prioritization and implementation timelines. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile of watershed area, and at 4.0 miles per square mile of riparian area. Many of these roads are poorly situated, constructed, and improperly maintained. Even though chronic fine sediment production decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to many forms of erosion, including culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (Environmental Science Associates 2004). Legacy roads from past logging activity, having been adopted as year-round roads and recreational trails, continue to impact the Soquel watershed. On many roads, located on both public and private lands, periodic maintenance occurs without any attempt to address chronic, localized erosion problems. In these circumstances, grading poorly drained roads and repairing failed fills and stream crossings can continue, and even exacerbate, the rate of fine sediment delivery into streams. Additionally, paved and unpaved roads parallel many of the waterways within Soquel Creek, likely constraining natural channel migration.
SqC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	30	City of Capitola, RWQCB, County of Santa Cruz, Santa Cruz RCD	16.67	16.67	16.67	16.67	16.67	100	Costs would depend on outreach success of the program.
SqC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, IWRP, Private Landowners, County of Santa Cruz, Santa Cruz RCD	45.25	45.25	45.25	45.25		181	Cost based on road inventory of 166 miles at a rate of $1,090/mile.
SqC-CCCS-23.1.1.5	Action Step	Roads/Railroads	Prioritize decommissioning of riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	20	CalFire, CalTrans, NRCS, Private Landowners, Redwood Empire, RWQCB, County of Santa Cruz, County of Santa Cruz Land Trust, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks	14.25	14.25	14.25	14.25		57	Cost will depend on landowner willingness to participate and site specific conditions. The most likely candidates for this recommendation include roads on State Parks, private timberlands, and Soquel Demonstration State Forest. Mainline public roads, although a major issue, are unlikely to be decommissioned due to common infrastructure and high property acquisition expense. Cost based on decommissioning 4 miles of riparian road network at a rate of $14,131/mile. If upgrading riparian roads, cost are estimated to total $96,000.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-23.1.1.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from steelhead streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	5	CalFire, City of Capitola, County of Santa Cruz						TBD	Cost based on amount of adequate spoils storage sites needed. Road inventory assessment should identify amount needed. Cost should is expected to be relatively small.
SqC-CCCS-23.1.1.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, City of Capitola, County of Santa Cruz	250	250	250	250		1,000	Cost based on treating 20 culverts at a rate of $50,000/culvert.
SqC-CCCS-23.1.1.8	Action Step	Roads/Railroads	Evaluate two stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	5	CalFire, City of Capitola, County of Santa Cruz, NRCS, Redwood Empire, RWQCB, County of Santa Cruz, Soquel Demonstration State Forest, State Parks	3,255					3,255	Encourage Soquel Demonstration State Forest to install a bridge or decommission a wet ford crossing on East Branch Soquel. Cost for providing passage (assume bottomless arch) at a rate of $255,000. Encourage County of Santa Cruz to replace the existing Redwood Lodge Road culvert on West Branch Soquel with a new bridge. Estimated cost for a new bridge at this location is approximately $3 million.
SqC-CCCS-23.1.1.9	Action Step	Roads/Railroads	Educate road associations and informal road maintenance collectives regarding the benefit of integrating into the Santa Cruz County Service Area process.	2	5	IWRP, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-23.1.1.10	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or steelhead watersheds.	3	20	CalFire, IWRP, NRCS, Santa Cruz RCD	56.50	56.50	56.50	56.50		226	This action should carefully balance impacts of riparian roads, future risks, and juxtaposition to important spawning and rearing areas. Although ambitious, this recommendation, by focusing on infrequently used and infrequently maintained high risk areas; should be considered a realistic goal with long-term benefits. Areas targeted will most likely included unsurfaced and infrequently used roads in the upper portion of the Soquel watershed. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on treating 16 miles of road network at a rate of 14,131/mile.
SqC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										
SqC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, City of Capitola, Private Landowners, Redwood Empire, County of Santa Cruz, Soquel Demonstration State Forest, State Parks						0	Cost accounted for in Prevent or minimize impairment to instream substrate.
SqC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Evaluate SCCRCD (2003) recommendations for passage improvements and prioritize accordingly.	2	10	IWRP, County of Santa Cruz, Santa Cruz RCD, USACE	3,643	3,643				7,285	Cost based on treating 14 barriers at a rate of $520,296/barrier. Cost may vary depending on size of stream and land use. Locations that impede wood movement in addition to salmonid movement should be considered a high priority for remediation.
SqC-CCCS-23.1.3.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, City of Capitola, NRCS, Redwood Empire, RWQCB, County of Santa Cruz, Soquel Demonstration State Forest, USACE						0	Use NMFS (2001) Guideline for Stream Crossings. Action is considered In-Kind
SqC-CCCS-23.1.3.3	Action Step	Roads/Railroads	Educate county policy staff and Board of Supervisors on the benefits of railcar bridges for use on private and provide information from other counties where they are commonly used.	3	5	CalFire, County of Santa Cruz, NMFS	10.00					10	Implementation of this recommendation could result in a significant cost savings for County of Santa Cruz.
SqC-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure										
SqC-CCCS-23.1.4.1	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SqC-CCCS-23.1.5.1	Action Step	Roads/Railroads	Conduct a road survey beginning with inner gorge roads in sandy soils followed by roads in other settings.	3	20	IWRP, NRCS, Santa Cruz RCD						0	Cost accounted for in other action step.
SqC-CCCS-23.1.5.2	Action Step	Roads/Railroads	Encourage RCD or NRCS to conduct private road assessments.	2	10	IWRP, NRCS, Santa Cruz RCD						TBD	An assessment of permanent and year-round access roads is required before a cost estimate can be estimated. Existing information and assessments conducted by the County and private consultants could (if compiled) result in a significant cost reduction.
SqC-CCCS-23.1.5.3	Action Step	Roads/Railroads	Document and improve THP access roads. The use of existing multiple-use roads to access THP parcels is common. This presents an opportunity to document existing conditions on private roads to improve the road database and for upgrading deficient roads.	3	100	CalFire, Private Landowners, Redwood Empire, Soquel Demonstration State Forest						0	This cost could be minimal if incorporated into future timber harvest plans. Action is considered In-Kind
SqC-CCCS-23.1.5.4	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	100	CalFire, Private Landowners, RWQCB, County of Santa Cruz, Soquel Demonstration State Forest						TBD	Costs cannot be determined at this time. An assessment of permanent and year-round access roads is required before a cost estimate can be estimated.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-23.1.5.5	Action Step	Roads/Railroads	Promote and expand the Rural Roads Program to individual and landowner associations.	2	10	IWRP, Santa Cruz RCD	25.00	25.00				50	Initial efforts should be focused on road networks in high risk areas and in areas with high rates of ongoing sediment delivery to important spawning and rearing areas. Cost will vary depending on landowner participation and the severity of the problem. Cost estimate is based on RCD staff time and expertise to assess and educate landowners over a ten year period.
SqC-CCCS-23.1.5.6	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.	2	5	County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-23.1.6	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance										
SqC-CCCS-23.1.6.1	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	25	City of Capitola, County of Santa Cruz Department of Public Works, Santa Cruz RCD, Soquel Demonstration State Forest						0	Action is considered In-Kind
SqC-CCCS-23.1.6.2	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.	2	100	City of Capitola, County of Santa Cruz Department of Public Works, Santa Cruz RCD, Soquel Demonstration State Forest						TBD	
SqC-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired water gravel quality and quantity)										
SqC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Encourage Redwood Empire and State Parks to address wetted road crossings and sediment runoff from their riparian roads located on Hinckley Creek, tributary to East Branch Soquel.	2	5	IWRP, Redwood Empire, County of Santa Cruz, State Parks						TBD	This road is used by residents in an inholding on Hinckley Creek and is a significant source of fine sediment input into a reach of stream close to where steelhead are found. The sediment should be stabilized within five years. Ultimately, this road should be closed and decommissioned.
SqC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, CalTrans, NRCS, Private Landowners, County of Santa Cruz Department of Public Works, Soquel Demonstration State Forest, State Parks						TBD	This is a cost that is frequently absorbed into road projects.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-CCCS-23.2.1.3	Action Step	Roads/Railroads	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.	2	10	County of Santa Cruz	250.00	250.00				500	Cost likely amounts to a 1/2 time position in the Soquel Creek/Aptos Creek watersheds. Costs were estimated over a ten year interval and will likely need further refinement if this recommendation is carried out over a longer duration.
SqC-CCCS-23.2.1.4	Action Step	Roads/Railroads	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	20	Private Landowners, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						TBD	Constant diligence will be necessary to minimize the impacts of unsanctioned trials and roads. Action is considered In-Kind
SqC-CCCS-23.2.1.5	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.	2	100	IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD						TBD	Inadequate road maintenance practices is most problematic on rural residential road networks, particularly those not subject to forest practice rules performance standards.
SqC-CCCS-23.2.1.6	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, County of Santa Cruz						0	Action is considered In-Kind
SqC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
SqC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	20	CalFire, CalTrans, City of Capitola, NRCS, RWQCB, County of Santa Cruz						TBD	Cost may vary significantly. However, a well designed road management plan should result in overall cost savings.
SqC-CCCS-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
SqC-CCCS-23.2.3.1	Action Step	Roads/Railroads	Amend County ordinances that discourage the use of inexpensive railcar bridges in favor of culverts.	3	20	CalTrans, County, NMFS						0	Action is considered In-Kind
SqC-CCCS-23.2.4	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
SqC-CCCS-23.2.4.1	Action Step	Roads/Railroads	Reduce sediment sources from road networks, maintenance activities, and other actions that deliver sediment to stream channels through improved, or new, laws and policies, and/or enforcement of existing laws and policies.	3	30	CalFire, CalTrans, City of Capitola, County of Santa Cruz Department of Public Works						0	Action is considered In-Kind
SqC-CCCS-23.2.4.2	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CalFire, CalTrans, City of Capitola, County of Santa Cruz Department of Public Works							Cost may vary significantly. However, a well designed road management plan should result in overall cost savings.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)										
SqC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC steelhead in any flood management activity (CDFG 2004).	2	100	City of Capitola, County of Santa Cruz, USACE						0	Action is considered In-Kind
SqC-CCCS-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SqC-CCCS-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, City of Capitola, IWRP, County of Santa Cruz, Santa Cruz RCD, USACE						TBD	Concentrated rainfall and extreme flood events could increase sediment input into Soquel Creek and tributaries from upslope locations. Much of the watershed is comprised of steep topography in erodible geology, which has led to frequent landslides. Accumulated fine sediment within the stream channel from upslope landslides has likely adversely impacted salmonid spawning and rearing habitats. Improved land-use practices will likely lower sediment yield rates following future flooding events. However, much of the watershed is considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions. Erosion assessment cost accounted for in other action steps. Assessment should identify protective measures for high-risk shallow-seeded landslides.
SqC-CCCS-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-CCCS-24.1.3.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with CCC steelhead recovery needs.	2	10	Private Landowners, County of Santa Cruz, Soquel Creek Water District, SWRCB						TBD	Due to the heavy over-drafting of water from Soquel Creek, the impact of a severe drought in conjunction with ongoing overdraft of the aquifer could be devastating to all lifestages of coho salmon and steelhead in the watershed. Although the watershed is Fully Appropriated and adjudicated, a water master is not appointed and there is no oversight of flow requirements. Required minimum bypass flows are not enforced for permitted surface water diversions and it is likely flows drop below mandated requirements in many stream reaches during the summer period. Additionally, even less oversight exists for ground water pumping in the watershed, which may impact baseflows more significantly than surface water diversions. Current demand for water exceeds the safe yield of local aquifers and is in danger of seawater contamination. Severe drought, particularly if occurring over a period of two or more years, would likely reduce flows significantly throughout the watershed, which would reduce overall salmonid abundance and compromise steelhead recovery goals for the Santa Cruz Mountains Diversity Stratum steelhead population.
SqC-CCCS-24.1.3.2	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead during droughts.	3	20	CalFire, CDFW, Private Landowners, RWQCB, SWRCB						0	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality. Action is considered In-Kind
SqC-CCCS-24.1.3.3	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	1	100	CDFW, SWRCB						0	Action is considered In-Kind
SqC-CCCS-24.1.3.4	Action Step	Severe Weather Patterns	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	3	100	IWRP, NRCS, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-24.1.3.5	Action Step	Severe Weather Patterns	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of steelhead and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	2	10	CDFW, City of Capitola, NMFS, RWQCB, Soquel Creek Water District, SWRCB						0	Action is considered In-Kind
SqC-CCCS-24.1.3.6	Action Step	Severe Weather Patterns	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	5	CDFW, City of Capitola, NMFS, RWQCB, Soquel Creek Water District, SWRCB	75.00					75	Cost based on hyrdologic model at a rate of $74,195/project.
SqC-CCCS-24.1.4	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity										
SqC-CCCS-24.1.4.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFW and NMFS OLE in sensitive spawning and rearing areas.	1	10	CDFW Law Enforcement, NMFS OLE						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-24.2	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
SqC-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										
SqC-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	3	100	CA Coastal Commission, City of Capitola, County of Santa Cruz, Santa Cruz RCD						0	Cost accounted for in ESTUARY.
SqC-CCCS-24.2.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SqC-CCCS-24.2.2.1	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	100	IWRP, NRCS, Private Landowners, County of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
SqC-CCCS-24.2.2.2	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	1	10	City of Capitola, IWRP, NRCS, SWRCB	37.50	37.50				75	Cost for stream flow model estimated at $74,195/project. Cost could be redundant with above action step if not coordinated.
SqC-CCCS-24.2.2.3	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, which will minimize water-use conflicts and impacts on fish and wildlife resources during drought conditions.	2	10	CDFW, NMFS, Soquel Demonstration State Forest, SWRCB						0	Action is considered In-Kind
SqC-CCCS-24.2.3	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity										
SqC-CCCS-24.2.3.1	Action Step	Severe Weather Patterns	Coordinate protection measures and develop rules for augmenting water supplies and mitigating the effects of drought on salmonids.	3	20							0	Action is considered In-Kind
SqC-CCCS-24.2.3.2	Action Step	Severe Weather Patterns	Work with CDFW, County of Santa Cruz, municipalities, and knowledgeable biologists to develop emergency rules and adopt implementation agreements that will allow operations to continue and protect critical steelhead lifestages.	2	5	CDFW, City of Capitola, NMFS, NRCS, Private Landowners, RWQCB, County of Santa Cruz, County of Santa Cruz Parks and Cultural Resources, Soquel Demonstration State Forest, State Parks, SWRCB, USFWS						0	Action is considered In-Kind
SqC-CCCS-24.2.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration										

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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SqC-CCCS-24.2.4.1	Action Step	Severe Weather Patterns	Maintain adult passage through the lower mainstem critical riffle areas during extreme droughts.	2	100	CDFW, NMFS	1.50	1.50	1.50	1.50	1.50	30	It is anticipated this would be a rare circumstance that would only be necessary under extreme low flow conditions and adequate spawning and rearing flows are available upstream. It is anticipated this type of action would only be necessary one or two times over the 100 year recovery horizion. Alley (2003) identified five critical riffles and believed these areas were a high priority. Costs are difficult to estimate and might require minimal modification with hand crews or modifications with mechanized equipment.
SqC-CCCS-25.1	Objective	Water Diversion/ Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SqC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										
SqC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of water quality conditions for rearing juvenile salmonids.	2	10	Private Landowners, RWQCB, SWRCB	7.50	7.50				15	Cost for continuous water quality monitoring estimated at $5,000/station. Assume minimum of 3 for lagoon. Cost does not account for maintenance or data management.
SqC-CCCS-25.1.2	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SqC-CCCS-25.1.2.1	Action Step	Water Diversion/ Impoundment	Develop water education programs to reduce water use directed at both municipal water users and those with riparian and appropriative water rights.	2	5	City of Capitola, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, SWRCB	20.00					20	
SqC-CCCS-25.1.2.2	Action Step	Water Diversion/ Impoundment	Work with water diverters in the lower West Branch of Soquel to evaluate and modify diversions that may impact rearing habitat quality.	2	15	IWRP, NRCS, Santa Cruz RCD, SWRCB						0	Action is considered In-Kind
SqC-CCCS-25.1.2.3	Action Step	Water Diversion/ Impoundment	Coordinate timing of water diversions to minimize the likelihood of fish stranding and stream dewatering.	2	100	Private Landowners, Santa Cruz RCD, Soquel Creek Water District, SWRCB						0	Action is considered In-Kind
SqC-CCCS-25.1.2.4	Action Step	Water Diversion/ Impoundment	Install passive flow bypass devices designed to allow diversion of water only when minimum streamflow requirements are exceeded.	2	20	CDFW, IWRP, Private Landowners, Santa Cruz RCD, SWRCB						0	CDFW should review diversions during period streambed alteration agreement updates and request installation of passive diversion devices where appropriate and feasible. Action is considered In-Kind
SqC-CCCS-25.1.2.5	Action Step	Water Diversion/ Impoundment	Encourage programs and entrepreneurial efforts by private organizations to purchase easements on water rights for maintenance of adequate surface flows.	2	20	IWRP, NRCS, County of Santa Cruz, County of Santa Cruz Land Trust, Soquel Creek Water District, SWRCB						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-25.1.2.6	Action Step	Water Diversion/ Impoundment	Encourage riparian water users that were assigned Class 2 water rights at the time of the adjudication to lease their water right portion to the City of Capitola.	3	20	CDFW, City of Capitola, Private Landowners, SWRCB						0	Based on claimed or estimated use at the time of the Soquel adjudication, the SWRCB assigned four classes of water right. The right assignment describes the user's maximum daily use in each of the four classes. The water desired in each class of user must be fully satisfied before water may be apportioned to the next higher numbered class. Within the riparian use classes, Classes 1,2, and 4, water is to be simultaneously shared among all the users of that class in proportion to the user's allotment in that class. This implies that if there is insufficient water to satisfy everyone's right a determination must be made of how much water is available. Riparian users with a Class 2 water right could release their water right to Capitola for protection of fish per California Water code section 1707. This would protect fish habitat by protecting streamflow leading to the lagoon and inflow into the lagoon. Action is considered In-Kind
SqC-CCCS-25.1.2.7	Action Step	Water Diversion/ Impoundment	Evaluate recycling waste water as a supplemental supply for irrigation and possibly groundwater recharge.	2	10	City of Capitola, IWRP, Public, RWQCB, Soquel Creek Water District, SWRCB						TBD	Use and recharging of recycled waste water would lead to reduced groundwater pumping which in turn could result in increased base flows in Soquel Creek.
SqC-CCCS-25.1.2.8	Action Step	Water Diversion/ Impoundment	Avoid and/or minimize the adverse effects of water diversion on CCC steelhead by establishing by-pass flows, season of diversion, and off-stream storage to create a more natural hydrograph.	3	15							TBD	Cost for off-channel storage dependent upon amount of optimum flow required for all life stages of fish.
SqC-CCCS-25.1.2.9	Action Step	Water Diversion/ Impoundment	Conduct water pumping overnight during the summer low-flow months.	2	100	City of Capitola, Private Landowners, Soquel Creek Water District, SWRCB						0	Streamflow is often the highest during nighttime hours as evaporation and vegetative transpiration are reduced. Municipal water suppliers should assess their operations during low-flow summer months. This recommendation would require significant landowner buy in, coordination, and cooperation. Action is considered In-Kind
SqC-CCCS-25.1.2.11	Action Step	Water Diversion/ Impoundment	Evaluate the feasibility and potential benefit of consolidating diversions to a centralized location lower in the watershed.	2	10	City of Capitola, County of Santa Cruz, NMFS, Private Landowners, Public, Soquel Water District, SWRCB						TBD	Removing water from the headwaters of the watershed limits the conjunctive use of that water for stream habitat functions. By removing water at the lowest point in the system the water becomes available to aquatic resources for rearing and growth (Alley 2003). Costs would likely be significant and major infrastructure upgrades would be necessary.
SqC-CCCS-25.1.2.12	Action Step	Water Diversion/ Impoundment	Promote water conservation by the public, water agencies, agriculture, private industry, and the citizenry.	3	50	City of Capitola, County of Santa Cruz, NMFS, Private Landowners, Public, Soquel Water District, SWRCB						0	This recommendation should be considered standard practice. Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-25.1.2.13	Action Step	Water Diversion/ Impoundment	Work with City of Santa Cruz and Soquel Water District to increase size of proposed desalination plant.	2	5	CDFW, City of Santa Cruz, NMFS						TBD	Cost of working with the City will be absorbed into ongoing HCP negotiations. Cost of expanding plant will result in a significant increase in cost to City Water Dept.
SqC-CCCS-25.1.3	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to passage and migration										
SqC-CCCS-25.1.3.1	Action Step	Water Diversion/ Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	10	CDFW, Private Landowners, SWRCB						TBD	All authorized surface water diverters should be notified of fish screen obligations. Notification should be followed by site visits within one year by CDFW and SWRCB staff to ensure diversion are in compliance. Estimate for fish screen is $60,60,950/screen.
SqC-CCCS-25.1.4	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to water quality (impaired stream temperature)										
SqC-CCCS-25.1.4.1	Action Step	Water Diversion/ Impoundment	Work with recovery partners to ensure water diversions do not impair water temperatures in the Soquel Creek.	1	100	CDFW, Private Landowners, SWRCB						0	As part of future streambed alteration agreements, CDFW should require installation of temperature thermographs upstream and downstream of diversion. These results should be reviewed by CDFW for every subsequent streambed alteration agreement. Action is considered In-Kind
SqC-CCCS-25.1.5	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize reduced density, abundance, and diversity										
SqC-CCCS-25.1.5.1	Action Step	Water Diversion/ Impoundment	Implement water conservation education programs.	3	20	City of Capitola, County of Santa Cruz, Santa Cruz RCD, Soquel Water District						0	Action is considered In-Kind
SqC-CCCS-25.1.5.2	Action Step	Water Diversion/ Impoundment	Education programs should be directed at both municipal water users and those with riparian and appropriate water rights.	3	5	City of Capitola, County of Santa Cruz, Santa Cruz RCD, Soquel Water District	80.00					80	Cost estimate derived from CDFG 2004.
SqC-CCCS-25.1.5.3	Action Step	Water Diversion/ Impoundment	Review Hydrology and Severe Weather strategies for additional recommendations.										
SqC-CCCS-25.2	Objective	Water Diversion/ Impoundment	Address the inadequacy of existing regulatory mechanisms										
SqC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SqC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Improve implementation of current laws and policies to control diversions and water use in order to maintain and restore surface flows.	3	50	City of Capitola, County of Santa Cruz, Soquel Water District, SWRCB						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	Appoint and adequately fund a Water Master to carry out the adjudication of water rights on Soquel Creek.	1	5	Private Landowners, County of Santa Cruz, Soquel Creek Water District, SWRCB	200.00					200	The watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board and placed under a statutory adjudication by court order in 1978. However, a water master to enforce the conditions of the adjudication has not occurred. The lack of oversight places the fishery at even greater risk. Surface water diversions and ground water pumping adversely impact almost all steelhead lifestages and are particularly deleterious during drought conditions. Water diversions result in excessively high water temperatures for steelhead in Soquel Creek and loss of surface flow. Loss of surface flow has been documented in 1992, 1994, and 2008.
SqC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	1	5	CDFW, City of Capitola, IWRP, County of Santa Cruz, Santa Cruz RCD, Soquel Creek Water District, SWRCB, USFWS						TBD	Diversions, from direct diversions and near stream wells, adversely impact the summer rearing lifestage and was determined to be the most significant threat to salmonids in the watershed. Water diversions and pumping of the alluvial aquifer reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat. A streamflow evaluation program should be developed in consultation with CDFW and NMFS. The program should develop rule curves, based on water year, that specifies flows necessary for salmonids to survive and thrive at all lifestages. Cost accounted for above.
SqC-CCCS-25.2.1.4	Action Step	Water Diversion/ Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	1	10	CDFW, IWRP, Soquel Creek Water District, SWRCB	12.00	12.00				24	Groundwater depletion is a limiting factor as well in the watershed and pieziometers will likely also be need to assess groundwater/surface water interactions. Gauging locations can be calibrated with the USGS gauge on Soquel Creek. Gauging sites should be located near areas with significant diversions and high value habitats. Likely locations include 1) lower Reach 1 immediately upstream of the lagoon, 2) upper Reach 1 downstream of Soquel Avenue near Walnut Street Park, 3) Reach 3 immediately downstream of the Bates Creek confluence, 4) in lower Reach 4 below the surface water diversion at the lower nursery, 5) in Reach 6 adjacent to the Mountain School, 6) Reach 9 below the Mill Pond diversion, Reach 13 of the West Branch near its mouth and below residential diversions. Other locations are likely necessary and should also be evaluated. Cost for stream flow gauges estimated at $1000/gauge. Cost does not account for maintenance or data management.
SqC-CCCS-25.2.1.5	Action Step	Water Diversion/ Impoundment	Request the SWRCB to conduct interagency consultation with CDFW, and seek technical assistance from NMFS on the issuance, perfection, or changes to water rights permits.	1	100	CDFW, NMFS, SWRCB						0	Action is considered In-Kind

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-25.2.1.6	Action Step	Water Diversion/ Impoundment	Identify and work with the SWRCB to address depletion of summer base flows from authorized and unauthorized water uses. Coordinated efforts by Federal, State, and County law enforcement agencies to remove illegal diversions from all streams in the Soquel Creek watershed.	1	10	CDFW, IWRP, NMFS, Private Landowners, State Water Resources Control Board						0	Action is considered In-Kind
SqC-CCCS-25.2.1.7	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and coho salmon.	3	10	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
SqC-CCCS-25.2.1.8	Action Step	Water Diversion/ Impoundment	Discourage new or increased surface water diversions, or groundwater pumping that depletes surface flows, for existing permit holders in Soquel Creek.	1	100	CDFW, NMFS, Private Landowners, County of Santa Cruz, SWRCB						0	No additional water diversions should occur in Soquel Creek. Water diversions and ground water pumping, which have depleted the aquifer, coupled with degraded instream habitat conditions, significantly degrade juvenile rearing opportunities during the summer period. Many stream reaches go dry during the summer juvenile rearing period, and this drying is unambiguously not due to natural conditions. A notable decline in base flow has occurred in the watershed since the 1950s as measured at the USGS Soquel Creek gage during dry periods. Balance Hydrologics, Inc. (2003) reported that the decrease was characterized by a drop in baseflows of two to four cfs resulting in dry period baseflows of zero to two cfs. The most likely cause of the decreases in baseflow are surface diversions and near-stream groundwater pumping. Action is considered In-Kind
SqC-CCCS-25.2.1.9	Action Step	Water Diversion/ Impoundment	Evaluate and monitor streambed alteration agreement compliance related to all water diversions (CDFG 2004) in Soquel Creek.	1	100	CDFW						0	Initial focus for compliance should be directed at the East Branch of Soquel Creek upstream of areas where steelhead were detected. Action is considered In-Kind
SqC-CCCS-25.2.1.10	Action Step	Water Diversion/ Impoundment	Encourage SWRCB to bring illegal water diverters (those unpermitted and permitted but out-of-compliance with permit terms) into compliance with State law.	1	5	CDFW, NMFS, Public, County of Santa Cruz, Soquel Creek Water District, SWRCB						0	Initial area of concentration should be directed at diversions in the East Branch of Soquel Creek where steelhead juveniles were detected. Action is considered In-Kind
SqC-CCCS-25.2.1.11	Action Step	Water Diversion/ Impoundment	Evaluate major groundwater diversions for impacts to surface flow.	2	10	CDFW, Private Landowners, Public, County of Santa Cruz, Soquel Creek Water District, SWRCB						TBD	Available information indicates the Soquel Creek Water District operates a deep-aquifer well near Main Street in Soquel Village and it draws underflow from Soquel Creek. This location and others should be assessed and if determined to impact surface flows, streambed alteration agreements and water rights should be reviewed and modified to ensure impacts to rearing habitats are minimized, particularly during the summer low flow period.
SqC-CCCS-25.2.1.12	Action Step	Water Diversion/ Impoundment	Develop and enforce stream flow bypass requirements for diversions in the Soquel Creek watershed.	1	10	CDFW, NMFS, NMFS OLE, SWRCB	50.00	50.00				100	Cost may vary considerably depending on existing baseflow and existing uses of water being diverted.

Soquel Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SqC-CCCS-25.2.1.13	Action Step	Water Diversion/ Impoundment	Minimum instream flows should be established for salmonids and recommendations implemented for all water diversions.	1	10	CDFW, City of Capitola, County of Santa Cruz, NMFS, Private Landowners, Soquel Creek Water District, SWRCB	125.00	125.00				250	Water diversions, including legal appropriative diversions, should be balanced to accommodate public trust doctrine concerns. Cost estimate is for a comprehensive IFIM type watershed study. NMFS (2008) estimated $50,440 for stream flow gaging and water balance model. Costs is Soquel - which is gaged - would likely be significantly more due to degree of overdraft and number of diversions. Cost estimate is very rough.

Waddell Creek Population

CCC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Santa Cruz Mountains
- Spawner Density Target: 500 adults
- Current Intrinsic Potential: 10.8 IP-km

Steelhead Abundance and Distribution

Waddell Creek is formed by the confluence of West and East Fork Waddell creeks, and consists of about 3.4 stream miles. West Waddell Creek consists of about 6.1 stream miles, and East Waddell Creek consists of about 3.5 stream miles (Becker and Reining 2008). On the West Fork, the uppermost limit to steelhead migration is Slippery Falls, located 2.6 miles upstream of the confluence. On the East Fork, the uppermost migration limit is located at the main falls, approximately 1.3 miles upstream of the confluence (Shapovalov and Taft 1954). The watershed drains approximately 24 square miles in northwestern Santa Cruz County (NMFS 2010). Waddell Creek terminates at a lagoon subject to tidal action during those portions of the year when it is not closed by a sandbar.

Waddell Creek is very diverse in the types of stream habitat it exhibits. The headwaters area is characterized by broad meadows with meandering streams and incised bedrock channels with boulder cascades and waterfalls. These channels traverse mixed coniferous forests, forming large deep pools and a turbulent stream that transition into mainstem areas.

Waddell Creek contains approximately six miles of potential spawning and rearing habitat (Hager Environmental Science 2004). During Shapovalov and Taft's (1954) seminal nine-year study period (1933-34 through 1941-42), the estimated steelhead run size ranged from 428 to 554 and averaged 481. As of 1967, local California Department of Fish and Game (CDFG) wardens estimated the adult steelhead run in Waddell Creek at 350 fish or more (Titus *et al*. 2010). Smith (in Becker and Reining 2008) estimated the adult run was in excess of 200 fish per year. As of 2000, in reference to Shapovalov and Taft's (1954) adult steelhead numbers, Rischbieter (2000) estimated the adult run was probably less than half of that (no methods for the estimate were given).

Smith (2013) conducted juvenile steelhead surveys in Waddell Creek from 1992 to 2013. Overall, YOY steelhead abundance in the Waddell Creek watershed in 2013 (19.5 per 100 feet) was below the values for 1992 to 1998 for the 15th consecutive year. Steelhead densities at four

of five mainstem sites were extremely low in 2013 (7 to 12 per 100 feet), as they have been since 1999. Densities were low (7 to 13 per 100 feet) on two upstream East Fork sites (Smith 2013) despite the presence of at least 33 steelhead redds during the previous winter (Jankovitz 2013). Densities at the two West Fork sites and the East Fork site immediately upstream of the confluence were comparatively high (30-36 per 100 feet)

In lower Waddell Creek, near the Highway 1 Bridge, seining surveys were conducted in 1970 and 1971. Juvenile steelhead were present throughout the survey area in both surveys. In 1980, CDFG surveyed the mainstem and east fork of Waddell Creek from the mouth to 12 km upstream. Juvenile steelhead densities at two 30-meter mainstem sites were 29 and 4 trout/m^2. Steelhead at one site in the lower east fork occurred at an estimated density of 14 trout/m^2 (Titus *et al*. 2010). The lagoon produced an estimated 2,500 steelhead in 1995 and 6,600 in 1996 (Smith 1997).

History of Land Use

Humans lived in or near Big Basin for at least 10,000 years before the Spanish explored the area in the late 1700s (CDPR 2011; Waddell Creek Association website). The Big Basin area was home to the Cotoni and Quiroste Indians. Spanish sea expeditions visited Waddell Valley as early as 1543. The Portola Expedition stopped there in 1769. A number of farming families settled in the lower part of the valley in the early 1800s. In the mid-1860s, there was an extensive timber harvesting operation in the area, which included a mill above the Waddell Forks, a lumber-hauling tramway from the mill to the beach, and a wharf in the lee of Point Ano Nuevo (CDPR 2011; Waddell Creek Association website).

Big Basin Redwoods State Park was established in 1902 (CDPR 2011). A major forest fire in 1904 devastated much of the Monterey Bay North Coast, including the Waddell Valley. Several selective timber harvests have been conducted since then. About 13 percent of the Waddell Creek watershed was logged between 1860 and 1966 (Titus *et al*. 2010). Farming in the lower Waddell Valley has continued until the present. In addition to the grazing of sheep and dairy cattle, a variety of crops has been grown at various times, including artichokes, sugar beets, hay, dairy products, and presently, organic vegetables.

Current Resources and Land Management

Big Basin Redwoods State Park constitutes the majority of land cover in the watershed, with small pockets of rural residential and agricultural use near the coast. Nearly 80 percent of the Waddell Creek drainage is within the boundaries of Big Basin State Park (Martin 2001). While

Waddell Creek is in relatively better condition than other streams in the region, it is far from pristine (NMFS 2011).

Salmonid Viability and Watershed Conditions

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

Current Conditions

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

Population and Habitat Conditions

Sediment Transport: Road Density

Excessive rates of sediment transport in the Waddell watershed have compromised spawning and rearing habitat. Pool filling appears to be occurring from sediment transport from upslope sources. Sources that have contributed to the altered sediment transport are most likely existing roads and associated maintenance.

Habitat Complexity: Large Wood & Shelter

According to NHI (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. Therefore, LWD is an even more critical habitat element than in more northern streams for forming pools or areas of refuge from high flows. Despite Fair LWD ratings for Waddell Creek, only one percent of the instream shelter values measured scored >80 and (thus were rated Poor). This suggests instream shelter is compromised due to high sediment loading, which may reduce the function and capacity of instream wood to create adequate shelter habitat (embeddedness values were also rated Poor). To improve shelter rating, LWD input should be evaluated in specific stream reaches where improvements may result in benefits, such as reaches with softer banks and reaches where LWD was rated below Very Good.

Water Quality: Turbidity or Toxicity

Water quality is likely significantly altered from practices in the watershed that degrade water quality and steelhead survival. One example is the suspected dumping of toxins in the East Branch of Waddell. Smith (2010) surveyed juvenile salmonid abundance in Waddell for 19 continuous years beginning in 1992. Since 1999, Smith noted substantially reduced juvenile abundance and hypothesized the decreased density was due to illegal dumping of toxins, possibly from Last Chance Gulch (Smith 2010). NMFS OLE special agents and CDFW game wardens investigated the watershed in 2008, but failed to detect potential toxin sources, and the County District Attorney sent letters to all residents in the Last Chance seeking information but to no avail. Other habitat alterations (such as major landslides) have also been evaluated, but to date no other apparent causes leading to low juvenile densities have been detected.

Threats

The highest rated threats and associated impacts to habitats (e.g., stresses) at various lifestages are outlined in the Waddell Creek CAP. Recovery strategies will likely focus on ameliorating High rated threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in the Waddell Creek CAP Results.

Fire and Fuel Management

Some areas in the Waddell watershed have a high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures, which are already above optimal condition in some stream reaches, would likely result.

Disease Predation and Competition

Disease, predation and competition were rated as a High threat to smolts due to the low abundance of this lifestage in the watershed and their inherent predation risk. Lower abundance may result from avian (e.g., gulls and mergansers), marine mammal, and potentially striped bass predation. This threat is likely increased by a low volume of escape cover (e.g., large wood and undercut banks) within Waddell Creek, and this lack of sufficient quantity of escape cover likely increases predation on juvenile by various predators.

Roads

Road densities are high throughout the watershed and are estimated at 2.0 miles of road per square mile of watershed area, and at 2.3 miles per square mile of riparian area. However,

although road densities are high, they are generally lower than most target watersheds in the Santa Cruz Mountains. Roads parallel much of the main stem and lower West Fork, and may be a source of fine sediment, but do not restrict channel migration.

Severe Weather Patterns

Heavy rainfall and extreme flood events could result in major erosion in upslope locations. Much of the watershed is comprised of steep topography in erodible geology. High instream sediment concentration can fill pools, smother spawning gravel, and generally simplify instream habitat complexity. Changing and improving land use practices (particularly road related issues) will likely lower sediment yield rates following future flooding events.

Limiting Conditions, Lifestages, and Habitats

Threat and condition analysis within the CAP workbook indicates all but the adult lifestage as being impaired in the Waddell Creek watershed, with summer rearing being the most stressed. Water quality and road conditions are likely the most significant limiting threats.

General Recovery Strategy

Improve Instream Habitat Quality and Quantity

Recovery actions should focus on retaining instream LWD and improving spawning habitat through placement of standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly-sized trees could be felled into stream channels to create these structures.

Winter habitat LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should be implemented and designed to provide cover, and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sediment sources within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep-seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Investigate and Address Impairments in East Branch Waddell

Fish populations have declined dramatically in the East Branch of Waddell Creek since 1999 (Smith 2013). Focused and persistent efforts by resource agency personnel and enforcement staff should continue until the origin of the impairment is discovered and addressed. Although the exact cause of the decline is unknown, available information suggests episodic input of unknown toxins, possibly originating from Last Chance Gulch or farther upstream on the East Fork (Smith 2013). The impairment not only affects steelhead abundance in the East Fork but also in the mainstem downstream of the East Fork confluence.

Investigate and Address Impairment to Waddell Estuary

Estuaries are complex ecosystems where ocean and freshwater interface, and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Santa Cruz Mountains diversity stratum. Restoration and threat abatement actions should address breaching, habitat availability and habitat suitability.

The sandbar closure frequency has changed, and these changes impact estuary productivity for juvenile rearing. Shapovalov and Taft (1954) documented that the sandbar closed the lagoon in eight of nine years during their study in the 1930s/early 1940s, while Smith (2010) documented that since at least 1995 the sandbar only formed in 2008 and 2009. This change in closure frequency has likely reduced the overall steelhead carrying capacity in Waddell Creek. Reasons for the change in closure frequency are not entirely clear, but Smith (2010) provided possible reasons, including changes to beach sand dynamics that may include possible interaction with the confined channel at the Highway 1 Bridge and/or Highway 1 berm and the State Park parking lot, and increases in the frequency of illegal breaching. Determining and correcting the reasons behind the changes to sandbar closure would provide essential information to guide future restoration and threat abatement measures. As at nearby Scott Creek, the California Department of Transportation is evaluating bridge replacement over Highway 1. If the bridge and/or parking lot are affecting sandbar closure dynamics, the problem should be considered and corrected during future bridge reconstruction. Finally, educational and enforcement measures should be directed at illegal sandbar breaching. Placing signs on the sandbar and educational material at the State Parks kiosk would be a low cost technique for minimizing the potential of illegal breaching. Increased enforcement by enforcement personnel would also prove helpful at reducing the frequency of illegal breaching.

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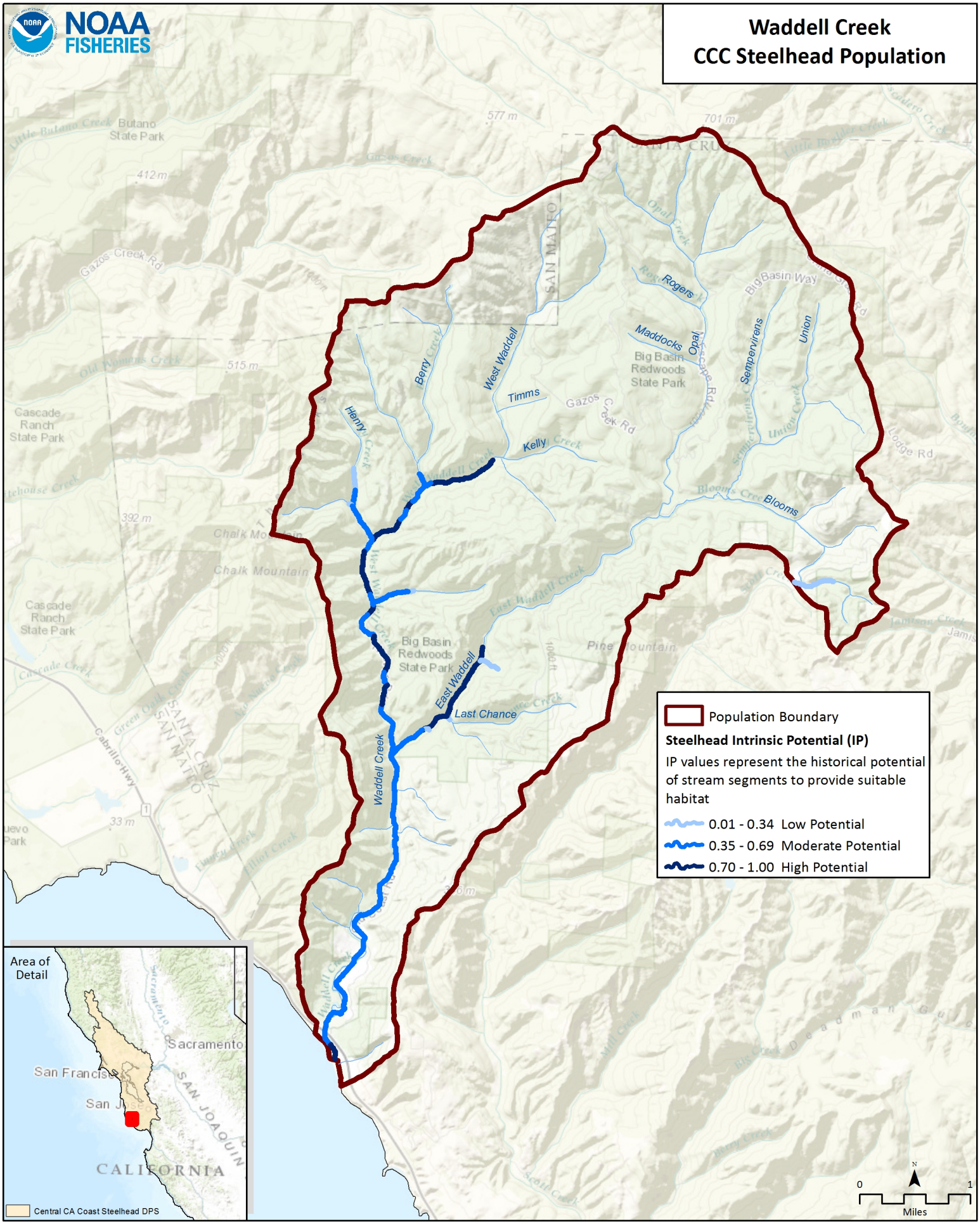
Waddell Creek
CCC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Sacramento
San Francisco
San Jose
CALIFORNIA
Central CA Coast Steelhead DPS
Waddell Creek
West Waddell
East Waddell
Last Chance
Henry
Berry
Timms
Kelly
Rogers
Maddocks
Opal
Sempervirens
Union
Blooms
Big Basin Redwoods State Park
Butano State Park
Cascade Ranch State Park
Chalk Mountain
Pine Mountain
Big Basin Way
Gazos Creek Rd
Cabrillo Hwy
SAN MATEO
SANTA CRUZ
0
1
Miles

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>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)	71% streams/ 83% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	14% streams/ 1% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	70-79% Density rating "D" across IP-km	Fair

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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 <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 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)	57% streams/ 28% IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>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)	57% streams/ 78% IP-km (>40% average primary pool frequency)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	71% streams/ 83% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	14% streams/ 1% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.84 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	86% streams 79% IP (>70% average stream canopy; >85% where coho IP overlaps)	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km		
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	57% streams/ 28% IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50% to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	<0.2 Fish/m^2	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% 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% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>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)	71% streams/ 83% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)		
			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		
			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	70-79% Density rating "D" across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	57% streams/ 28% IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	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		
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)	14% streams/ 1% 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	0.84 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			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	Acute	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	0.17% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.317% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	75-100% Intact Historical Species Composition	75-100% Intact Historical Species Composition	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.0 Miles/Square Mile	Good
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.3 Miles/Square Mile	Poor

Waddell Creek CAP Threat Results

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

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WdC-CCCS-1.1.1	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
WdC-CCCS-1.1.1.1	Action Step	Estuary	Promote and evaluate alternatives to the current Highway One bridge to improve estuary function.	2	10	CalTrans, CDFW, State Parks, USACE, USFWS	161.00	161.00				TBD	The current bridge is planned for a rebuild by Caltrans. A new bridge should account for sandbar formation and likely impacts to lagoon function. A new structure should be constructed to have minimal influence on sandbar opening and closing during all potential water years. Cost could not be determined at this time due to unknown financial considerations being evaluated by Caltrans for bridge design and reconstruction. The bridge location may have resulted in some channel incision which isolates the channel from the marsh and results in a lack of backwater habitat in the estuary. Cost estimated at $321,745/project.
WdC-CCCS-1.1.1.2	Action Step	Estuary	Evaluate alterations to river mouth dynamics and implement changes to restore natural function	2	10	CalTrans, State Parks						TBD	The current bridge and parking lot configuration should be closely evaluated and adverse impacts remediated to improve sand bar dynamics. A proposed rebuild of the Waddell Highway 1 bridge provides a rare opportunity within the range of CCC steelhead to reclaim historical estuary dynamics. The sandbar closure frequency has changed, and these changes impact estuary productivity for rearing juvenile. This change in closure frequency has likely reduced the overall salmonid carrying capacity in Waddell Creek . Reasons for the change in closure frequency are not entirely clear, but Smith (2010) provided possible reasons, including changes to beach sand dynamics that may include possible interactions with the confined channel at the Highway 1 Bridge and/or Highway 1 berm and the State Park parking lot, and increases in the frequency of illegal breachings. Determining and correcting the reasons behind the changes to sandbar closure would provide essential information to guide future restoration and threat abatement measures.
WdC-CCCS-1.1.2	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
WdC-CCCS-1.1.2.1	Action Step	Estuary	Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.	2	10	CDFW, IWRP, Santa Cruz RCD, State Parks	320.50	320.50				641	Costs may vary depending on the total number of structures and necessary engineering. Due to the lack of instream infrastructure (after the Highway 1 bridge is replaced) it is likely that relatively little engineering will be necessary. Permitting costs are anticipated to be negligible to likely use of programmatic permits. Cost for treating 2 acres (assume 5% of total estuarine acres) at a rate of $320,453/acre.
WdC-CCCS-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
WdC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Address channel incision issues and reduced stream complexity between the Highway one bridge (stream mile 0) and the footbridge (stream mile 8).	2	10	Caltrans, County of Santa Cruz	288.00	288.00				576	Costs are based on $29,440/mile for stream complexity actions and $42,448/mile for floodplain projects because the projects will work in concert with each other over the 8 mile section.
WdC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WdC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										
WdC-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. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility.	3	5	CDFW, NOAA RC, Santa Cruz County, Santa Cruz RCD	51.00					51	Cost based on treating 1.7 miles (assume 1 project/mile in 50% high IP) at a rate of $29,640/mile.
WdC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Explore restoration approaches to regain flooding of the north and south swale during more frequent flow events. Address channel incision issues and reduced stream complexity between the Highway one bridge (stream mile 0) and the footbridge (stream mile 8).	2	5	CDFW, NOAA RC, Santa Cruz County, Santa Cruz RCD, State Parks	160.00					160	Accurate costs depend on selected approaches. CDFW estimated LWD installation costs at approximately $20K/mile (CDFG 2004).
WdC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency										
WdC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	15	CDFW, NOAA RC, Santa Cruz County, Santa Cruz RCD, State Parks						85	Cost based on riparian restoration monitoring at a rate of $84,124/project.
WdC-CCCS-6.1.2.2	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	10	IWRP, State Parks	74.00	74.00				148	To improve shelter, LWD input should be evaluated in specific stream reaches where improvements are anticipated to result in benefits such as reaches with softer banks, and reaches where LWD rated below Very Good. Cost estimate based on CDFG 2004, at approximately $28,500/mile, and assuming approximately 5 miles would be treated. Costs will be higher if engineered large wood placement approaches are used. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody debris should be targeted to reach density and volume outlined in the Viability table in this document. Cost for treating 5 miles with large wood placement is $147,202 and $595,404 for Engineered Log Jams, respectively.

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-6.1.2.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	California Coastal Conservancy, CDFW, Private Landowners, Santa Cruz RCD, State Parks, USACE						TBD	Cost should be minimal. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects.
WdC-CCCS-6.1.2.4	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical steelhead rearing habitats in Waddell Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	California Coastal Conservancy, CDFW, Private Landowners, Santa Cruz RCD, State Parks, USACE						TBD	
WdC-CCCS-6.1.2.5	Action Step	Habitat Complexity	Conserve and manage forestlands for older forest stages.	3	100	California Coastal Conservancy, CDFW, Private Landowners, Santa Cruz RCD, State Parks, USACE						0	Action is considered In-Kind
WdC-CCCS-6.1.2.6	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	30	CalFire, Private Landowners, Santa Cruz County, State Parks						TBD	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Much of Waddell Creek is encompassed by Big Basin State Park where such a program would likely be isolated to discrete areas. This program would likely involve less effort than in other more heavily managed watersheds in the Santa Cruz Mountains Diversity Stratum. Estimate for riparian thinning is $1,673/acre.
WdC-CCCS-6.1.3	Recovery Action	Habitat Complexity	Improve shelter										
WdC-CCCS-6.1.3.1	Action Step	Habitat Complexity	Increase shelters to optimal conditions (>80 pool shelter value) in mainstem Waddell Creek.	2	10	California Coastal Conservancy, CDFW, Private Landowners, Santa Cruz RCD, State Parks, USACE	103.50	103.50				207	Cost based on $29,440/mile for 7 miles of mainstem Waddell Creek. Cost of improving shelter could be part of increasing large wood frequency.
WdC-CCCS-6.1.3.2	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts. Create winter velocity refuge between stream mile 4 and 8 (footbridge). Create winter velocity refuge in stream above and below tramway springs.	2	100	CDFW, IWRP, State Parks						0	Cost accounted for in above action steps.
WdC-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WdC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
WdC-CCCS-8.1.1.1	Action Step	Sediment	Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations	3	10	CDFW, IWRP, State Parks	28.00	28.00				56	Cost for erosion assessment estimated at $14.39/acre (assume 25% of total watershed acres).

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-8.1.1.2	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	California Coastal Conservancy, CalTrans, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	15.73	15.73				31	Cost based on $13,680/mile for 2.3 miles of riparian road.
WdC-CCCS-8.1.1.3	Action Step	Sediment	Remediate slides and gullies delivering sediment to stream channels.	3	20	IWRP, State Parks						TBD	Cost based on amount of gullies and slides to be treated. Cost estimated at $456/ft.
WdC-CCCS-8.1.1.4	Action Step	Sediment	Remediate near stream sediment sources such as streamside landings, roads, and failing banks using appropriate techniques.	2	30	IWRP, State Parks						TBD	Cost based on amount of near stream sediment sources needing treatment.
WdC-CCCS-8.1.1.5	Action Step	Sediment	Establish and/or maintain continuous and properly functioning native riparian buffers.	3	100	State Parks						0	Riparian buffers adjacent to agricultural field in the lower watershed should be carefully monitored over time. Any encroachment into the existing riparian buffer should be discouraged. Action is considered In-Kind
WdC-CCCS-8.1.1.6	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	10	CDFW, IWRP, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	670	670				1,340	CDFW estimated LWD structures cost approximately $20K each (CDFG 2004). Assumed 50 structures would be needed. Significant cost reduction could be realized in Waddell if less engineered structures (felling of riparian trees into watercourses) are used in the watershed. This approach may be more applicable in this watershed due to the paucity of near stream infrastructure.
WdC-CCCS-8.1.1.7	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	2	15	NRCS, RWQCB, Santa Cruz County, Santa Cruz RCD						TBD	This work would be in addition to the road evaluation study. Cost savings could be realized through the use of air photography and interviews with landowners to identify major sources of sediment input.
WdC-CCCS-10.1	Objective	Water Quality	Address the inadequacy of existing regulatory mechanisms										
WdC-CCCS-10.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants										

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-10.1.1.1	Action Step	Water Quality	Identify source of ongoing low fish abundance in upper East Waddell Creek and implement appropriate remediation and restoration actions.	1	3	CDFW, NMFS OLE, State Parks	50.00					50	Installation of continuous monitoring water quality gauges should begin as soon as possible. Relatively few threats exist in the watershed and habitat quality is better than many streams in the Santa Cruz Mountains. Nonetheless, fish density is very low compared to historical conditions and salmonids are nearly extirpated. Dr. Jerry Smith has sampled the watershed since 1988 and believes the low density is due to episodic dumping of toxic chemicals or other substance that has severely degraded water quality conditions for successful juvenile rearing in East Waddell Creek. NMFS OLE special agents and CDFW game wardens investigated the watershed in 2008 but failed to detect potential toxin sources. Other habitat alterations (such as major landslides) have also been evaluated, but to date no other apparent causes leading to low juvenile densities have been detected. Cost for continuous water quality stations estimated at $5,000/station. Assume a minimum of 10. Cost does not account for maintenance or data management.
WdC-CCCS-10.1.1.2	Action Step	Water Quality	Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals or other associated practices into East Branch Waddell.	1	5	CDFW, NMFS OLE, Private Landowners, RWQCB, State Parks						TBD	
WdC-CCCS-10.1.1.3	Action Step	Water Quality	Initiate a water quality monitoring program in E. Br. Waddell.	1	5	CDFW, IWRP, NMFS, RWQCB, USEPA	45.00					45	Assessed water quality parameter should include pH and ammonia. Water quality from treatment plant should be closely evaluated.
WdC-CCCS-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WdC-CCCS-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity based on the biological recovery criteria										
WdC-CCCS-11.1.1.1	Action Step	Viability	Evaluate benefits of re-establishing a life cycle station in Waddell Creek.	3	15	CDFW, NOAA SWFSC							Consideration should be given to re-establishing the monitoring program pioneered by Shapovalov and Taft (1954) in Waddell Creek during the 1930s. Cost estimates are very rough and would include construction of a new weir and operation of the station for 15 years. See Monitoring Chapter for costs associated with Lifecycle Monitoring Stations.
WdC-CCCS-14.1	Objective	Disease/ Predation/ Competition	Address disease or predation										
WdC-CCCS-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity										

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-14.1.1.1	Action Step	Disease/ Predation/ Competition	Evaluate impacts of striped bass predation in the Waddell estuary to juvenile and smolting salmonids and implement abatement strategies if appropriate.	3	10	CDFW, IWRP, State Parks	67.00	67.00				134	Final reports should include a series of recommendations and the feasibility of implementing these recommendations. Accurate implementation cost cannot be determined until all potential control methods are evaluated and total magnitude of the impact of anadromous salmonids ascertained. Some researchers believe striped bass are not a major constraint. Total duration of predator control efforts may be longer depending on recommendations of plan. Cost for abundance/distribution surveys estimated at $133,660/project.
WdC-CCCS-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WdC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology										
WdC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, State Parks						0	Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lowering stream flows during water drafting. Action is considered In-Kind
WdC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
WdC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.	3	5	CalFire, CDFW, Santa Cruz County, Santa Cruz RCD, USFWS						0	Action is considered In-Kind
WdC-CCCS-15.1.2.2	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	2	10	CalFire, CDFW, Santa Cruz County, Santa Cruz RCD	48.50	48.50				97	Cost based on effects of wildfire on ecosystem at a rate of $96,960/project.
WdC-CCCS-15.1.2.3	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	3	25	CalFire, CDFW, Santa Cruz County, Santa Cruz RCD						0	Cost accounted for in above action step.
WdC-CCCS-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
WdC-CCCS-15.1.3.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	1	100	CalFire						0	This should be considered a standard practice by firefighting organizations. Action is considered In-Kind
WdC-CCCS-15.1.4	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WdC-CCCS-15.1.4.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire						0	Action is considered In-Kind
WdC-CCCS-15.2	Objective	Fire/Fuel Management	Address the inadequacy of existing regulatory mechanisms										

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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WdC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WdC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams with 300 feet of riparian areas. To the maximum extent feasible, orient air drops so that the drop lands perpendicular to streams.	2	100	CalFire						0	Action is considered In-Kind
WdC-CCCS-15.2.1.2	Action Step	Fire/Fuel Management	Disseminate recommendation from NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	3	5	CalFire, State Parks						0	Action is considered In-Kind
WdC-CCCS-15.2.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	1	100	CalFire, CDFW, NMFS, USFWS						0	The resource agencies can provide guidance regarding critical resources in areas that may be affected by firefighting actions. Action is considered In-Kind
WdC-CCCS-15.2.1.4	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	2	100	CalFire, CDFW, USFWS						0	Costs are developed for the Aptos watershed and the guidance could be applied elsewhere. Action is considered In-Kind
WdC-CCCS-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize reduced density, abundance, and diversity										
WdC-CCCS-15.2.2.1	Action Step	Fire/Fuel Management	Develop measures protective of salmonids during fire suppression activities.	3	25	CalFire, NMFS						0	Action is considered In-Kind
WdC-CCCS-15.2.2.2	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing fire fighting assistance in the Waddell Creek watershed (and all other watersheds in the County).	2	5	CalFire						0	Cost of providing the plan is minimal. Action is considered In-Kind
WdC-CCCS-15.2.2.3	Action Step	Fire/Fuel Management	Reassess fire risk every ten years.	3	100	CalFire, Santa Cruz County, State Parks						0	Action is considered In-Kind
WdC-CCCS-15.2.2.4	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	10	CalFire, Santa Cruz County	10.00	10.00				20	
WdC-CCCS-15.2.3	Recovery Action	Fire/Fuel Management	Prevent or minimize adverse alterations to riparian species composition and structure										
WdC-CCCS-15.2.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	2	5	CalFire, CDFW, NMFS, NRCS, Santa Cruz County, State Parks, USFWS						0	Costs are developed for the Aptos watershed. The fire plan could be used from the Scott watershed. Action is considered In-Kind
WdC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WdC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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WdC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or steelhead watersheds.	2	10	CalTrans, IWRP, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD	29.00	29.00				58	Road densities are high throughout the watershed and are estimated at 2.0 miles of road per square mile of watershed area, and at 2.3 miles per square mile of riparian area. However, although road densities are high, they are generally lower than most target watershed in the Santa Cruz Mountains. Roads parallel many of the waterways within Waddell Creek and restrict channel migration and other fluvial processes. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on $14,131/mile for decommissioning 4.1 miles of road (10% of 41 miles of road network).
WdC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	20	CalTrans, IWRP, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD	92.75	92.75	92.75	92.75		371	Cost based on $74,190/unit with 5 of the 11 crossings being treated. The complexity of the crossings could result in each unit costing $1,190,573, resulting in an estimate of $5,952,869.
WdC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads and trails, and the types of best management practices protective of salmonids.	3	20	CalTrans, IWRP, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD						0	Action is considered In-Kind
WdC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Continue education of Caltrans and State Parks staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	60	CalTrans, IWRP, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD						0	Action is considered In-Kind
WdC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
WdC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	100	CalFire, State Parks	1.40	1.40	1.40	1.40	1.40	28	Cost based on treating 2 miles at a rate of $13,680/mile.
WdC-CCCS-23.1.2.2	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	IWRP, Santa Cruz RCD, State Parks	43.50	43.50				87	Cost accounted for erosion assessment. Cost for road inventory estimated at $1,056/mile.
WdC-CCCS-23.1.2.3	Action Step	Roads/Railroads	Educate users (including mountain bikers, hikers, ORV users, etc) to help prevent or control erosion and sediment problems along the stream.	3	30	RWQCB, State Parks	8.33	8.33	8.33	8.33	8.33	50	
WdC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
WdC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Design new roads to minimize unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, NRCS, Private Landowners, State Parks						0	Action is considered In-Kind
WdC-CCCS-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure										

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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WdC-CCCS-23.1.4.1	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2011) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	Santa Cruz County, State Parks						0	Action is considered In-Kind
WdC-CCCS-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
WdC-CCCS-23.1.5.1	Action Step	Roads/Railroads	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.	3	10	California Department of Mines and Geology, CDFW, Private Landowners	11.50	11.50				23	Cost based on erosion assessment for 1,542 acres (assume 10% of total acres) at a rate of $14.39/acre.
WdC-CCCS-23.1.5.2	Action Step	Roads/Railroads	Use best available management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	15	CalFire, IWRP, Private Landowners, Santa Cruz RCD, State Parks						0	These standards should be applied to all roads in the watershed. Action is considered In-Kind
WdC-CCCS-23.1.5.3	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CDFW, IWRP, NRCS, San Mateo RCD	15.00	15.00				30	
WdC-CCCS-23.1.6	Recovery Action	Roads/Railroads	Prevent or minimize impairment to the estuary (impaired quality and extent)										
WdC-CCCS-23.1.6.1	Action Step	Roads/Railroads	Remove structures impairing or reducing the historical tidal prism where feasible and where benefits to steelhead and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism from the proposed bridge replacement for the Highway 1 bridge over Scott Creek lagoon.	2	10	CalTrans, CDFW, NMFS, USACE, USFWS						TBD	Cost cannot be determined due to the unknown number of projects in the area and landowner willingness to assist in estuary restoration. It is likely that other projects will occur opportunistically over the next 100 years recovery horizon and should implemented when landowners are willing and funding is available. Caltrans is currently evaluating bridge replacement - differentiating between anticipated replacement costs and additional actions for steelhead and coho salmon recovery benefits can not be estimated at this time due to uncertainty regarding Caltrans preferred alternative. Replacement of the bridge offers a rare opportunity to improve rearing conditions in an important habitat.
WdC-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
WdC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
WdC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.	2	100	CalFire, Santa Cruz County, State Parks						0	Hydrologically disconnect roads where appropriate. Action is considered In-Kind
WdC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	State Parks						0	Action is considered In-Kind

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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WdC-CCCS-23.2.1.3	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	3	100	CalFire, PG&E, Santa Cruz County						0	Action is considered In-Kind
WdC-CCCS-23.2.1.4	Action Step	Roads/Railroads	Encourage enforcement of Erosion Control Ordinance for private roads.	3	100	RWQCB, Santa Cruz County						0	County should provide adequate staffing to ensure standards per their Erosion Control Ordinances are applied appropriately. Action is considered In-Kind
WdC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance										
WdC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific road management plan is created and implemented.	2	10	County of Santa Cruz, Private Landowners, Santa Cruz County, State Parks						0	Action is considered In-Kind
WdC-CCCS-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
WdC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
WdC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Minimize future diversions from sources of cool water input	2	100	CDFW, State Parks, SWRCB						0	Sources of cool water input should not be diverted, particularly during drought periods. Action is considered In-Kind
WdC-CCCS-24.1.1.2	Action Step	Severe Weather Patterns	Identify and work with water users and appropriate regulatory agencies to minimize depletion of summer base flows from unauthorized water uses.	2	10	CDFW, Farm Bureau, NMFS, Private Landowners, State Parks, SWRCB						0	Cost should be minimal and would largely consist of staff time to reconnoiter the watershed and conduct outreach to landowners. Action is considered In-Kind
WdC-CCCS-24.1.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for steelhead recovery purposes, particularly under drought conditions. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	2	100	CalPoly, NMFS, Private Landowners, RWQCB, Santa Cruz County Fish and Wildlife Advisory Board, SWRCB, Trout Unlimited						TBD	The price at which water is sold on environmental markets is determined by negotiations between landowners and purchasing entity. In circumstances where potential agricultural sellers of water rights do not shift to groundwater pumping or make other arrangements such that lands are not left fallow, potential sellers may forgo the agricultural profits they would have gained from irrigating. Cost will vary depending on water availability and landowner participation. It is unknown if this program will gain widespread acceptance in the watershed and therefore costs cannot be estimated. However, it is recommended that the equations used in the State Coho Plan for socioeconomic costs be utilized when more information regarding landowner participation is gathered.
WdC-CCCS-24.2	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
WdC-CCCS-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)										
WdC-CCCS-24.2.1.1	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	2	100	County, Federal, State						0	New bridges and upgrades to parking lots should evaluate future impacts associated with sea level rise. Cost accounted for in ESTUARY.

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-24.2.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (impaired stream temperature)										
WdC-CCCS-24.2.2.1	Action Step	Severe Weather Patterns	Ensure adequate water temperatures are maintained during drought periods.	2	100	IWRP, Private Landowners, SWRCB	0.08	0.08	0.08	0.08	0.08	2	Cost based on installing a minimum of 3 stream temperature gauges at a rate of $500/gauge.
WdC-CCCS-24.2.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
WdC-CCCS-24.2.3.1	Action Step	Severe Weather Patterns	Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical steelhead watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	20	County, Federal, Santa Cruz RCD, State						0	Action is considered In-Kind
WdC-CCCS-24.2.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
WdC-CCCS-24.2.4.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions. Critical flow values during droughts should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFW, NMFS, State Parks, SWRCB	32.50	32.50				65	Cost for stream flow model estimated at $65,084/project.
WdC-CCCS-24.2.4.2	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							0	Action is considered In-Kind
WdC-CCCS-24.2.4.3	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFW, NMFS, State Parks, SWRCB						0	Cost accounted for in above action step.
WdC-CCCS-24.2.4.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for steelhead at all life stages, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	3	10	CDFW, NMFS, State Parks, SWRCB						0	Action is considered In-Kind
WdC-CCCS-24.2.4.5	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	2	5	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, Private Landowners, Public, SWRCB						0	Action is considered In-Kind
WdC-CCCS-24.2.5	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
WdC-CCCS-24.2.5.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	California Geological Survey, Santa Cruz County, State Parks						0	Heavy rainfall and extreme flood events could result in major erosion in upslope locations. Much of the watershed is comprised of steep topography in erodible geology. High instream sediment concentration can fill pools, smother spawning gravel, and generally simplify instream habitat complexity. Cost accounted for in other action steps.

Waddell Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WdC-CCCS-24.2.5.2	Action Step	Severe Weather Patterns	Minimize future urban development in floodplains or off channel habitats.	1	100	California Geological Survey, CalTrans, Private Landowners, Santa Cruz County, USACE						0	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. Cost cannot be determined at this time due to a lack of information regarding where these existing habitats remain in juxtaposition to future development.

CCC Steelhead DPS Rapid Assessment Profile: Santa Cruz Mountains Diversity Stratum Populations

San Pedro Creek

- Role within DPS: Dependent Population
- Spawner Abundance Target: N/A
- Current Intrinsic Potential: N/A

Tunitas Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 62-126 adults
- Current Intrinsic Potential: 10.7 IP-km

Gazos Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 73-148 adults
- Current Intrinsic Potential: 12.5 IP-km

San Vicente Creek

- Role within DPS: Dependent Population
- Spawner Density Target: 32-66 adults
- Current Intrinsic Potential: 5.7 IP-km

Laguna Creek

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

Steelhead Abundance and Distribution

San Pedro Creek. The San Pedro Creek watershed drains approximately 8.7 square miles of the northern Santa Cruz Mountains in San Mateo County and encompasses four primary subwatersheds: North Fork, Middle Fork, South Fork, and Sanchez Fork. San Pedro has a small, open estuary that receives perennial flow year round.

There are approximately 4.2 miles of accessible spawning and rearing habitat for steelhead. As of 1968, the local CDFG warden estimated the adult steelhead run at 100 individuals, and Anderson (1974) estimated the run at between 100 and 250 individuals. In 1976, the local CDFG

warden estimated 60 adult steelhead had been poached at the Adobe Road crossing alone, and approximately 40 pairs were observed spawning in the Middle Fork during the winter of 1984-85 (Titus *et al.* 2010). In April 2008, at least 16 adults and several smolts were observed in the estuary (Joel Casagrande, NMFS, personal observation). During the winter of 2011-12, redd surveys were conducted throughout a 1.117 kilometer reach of the Middle Fork San Pedro Creek; no redds or steelhead adults were observed (Jankovitz 2012). However, during the winter of 2012-13, Jankovitz (2013) observed 12 steelhead redds (10 redds per kilometer) and one adult steelhead in the same reach of the Middle Fork San Pedro Creek. In July 2014, a single, post-spawned adult female and several smolt-sized juveniles were collected from the San Pedro Creek lagoon during the dewatering phase of the Highway 1 Bridge replacement (Joel Casagrande, NMFS, personal communication, August 2014).

Numerous surveys of juvenile steelhead distribution and abundance have occurred in San Pedro Creek (Titus *et al.* 2010). In the summer of 1973, juveniles were very abundant throughout the watershed with densities between 55 and 221 fish per 100 feet (Anderson 1973). Similar densities were also found in 1974 (Anderson 1974) but were much lower in 1976 and 1979 (Titus *et al.* 2010). In 1988, 1989, and 1995, juvenile steelhead were again very abundant throughout the lower mainstem (CDFG 1988, Sullivan 1990, Titus *et al.* 2010). HES (2002) observed juvenile steelhead in all accessible habitats in summer 2001 and noted the highest abundance was in the Middle Fork and upper mainstem. Similarly, Johnson (2005) observed juvenile steelhead in all accessible habitats in the fall 2004, and also noted abundance was greatest in the Middle Fork and upper mainstem.

Tunitas Creek. The Tunitas Creek watershed drains approximately 11.5 square miles of the Santa Cruz Mountains in western San Mateo County and includes two primary subwatersheds: East Fork Tunitas Creek and Dry Creek. There are approximately 11.7 miles of potential habitat for steelhead, including a small lagoon.

Shapovalov (1939) found juvenile steelhead to be common throughout lower Tunitas Creek, including the tidal portion, and noted steelhead abundance declined with distance upstream. In 1962, the local CDFG warden estimated the adult run size at approximately 100-200 individuals. In October 1962, juvenile steelhead abundance averaged 26 fish per 100 feet at four sites on the mainstem. These consisted mostly of age 0+ fish and were observed almost exclusively downstream of the East Fork confluence (CDFG 1962). On July 28, 1964, juvenile steelhead abundance was approximately 30 fish per 100 feet in the lower East Fork (CDFG 1964). CDFG conducted extensive habitat surveys throughout the watershed in summer of 2006. Juvenile steelhead (or resident trout) were observed in moderate to low densities throughout Tunitas Creek, as well as the downstream portions of the East Fork and Dry Creek (Becker and Reining

2008). Habitat quality increased with distance upstream and excess fine sediment, flow diversions, and riparian vegetation clearing for equestrian access were noted as impairments (J. Nelson, CDFW, personal communication, August 2013).

Gazos Creek. Gazos Creek drains approximately 12 square miles of the Santa Cruz Mountains in western San Mateo and Santa Cruz counties and encompasses two significant subwatersheds, Old Womans Creek and Middle Fork Gazos Creek (Conrad *et al.* 2003). Gazos Creek enters the Pacific Ocean approximately 25 miles north of the City of Santa Cruz. About 13.2 miles of potential habitat exist in the watershed, and a small lagoon forms at the mouth of the creek during the dry season.

Estimates of the historic and current run size of the adult steelhead in Gazos Creek are not available. However, numerous assessments of juvenile steelhead abundance have been conducted since the 1960s, many of which are summarized in Titus *et al.* (2010). Recent redd surveys conducted by CDFW have confirmed spawning by steelhead in Gazos Creek. During the winter of 2011-12, 11 steelhead redds (1.09 redds per kilometer) and two adult steelhead were observed throughout the anadromous portion of Gazos Creek (Jankovitz 2012). No redds were observed in a 1.6 kilometer reach of Old Woman's Creek. During the winter of 2012-13, 13 steelhead redds (4.2 redds per kilometer) were observed in a single reach 3.09 kilometers long (Jankovitz 2013).

Dr. Jerry Smith of San Jose State University has conducted annual surveys of juvenile steelhead and coho salmon at multiple sites throughout Gazos Creek between 1992 and 2012 (except 2008). Mean densities of juvenile steelhead during this period were 43 fish per 100 feet (35 Age 0+ and 8 Age 1+ or older). Juvenile steelhead densities downstream of Old Woman's Creek were almost always substantially less than at sites upstream because of poor substrate conditions and fine sediment loading from Old Women's Creek. The densities of yearlings and older fish are relatively high compared to other streams in the region. Between 2006 and 2010, Age 0+ steelhead densities were much lower (16-21 fish per 100 feet) than the long-term mean and were partially attributed to reduced access to better spawning habitat in the upper watershed by multiple large log jams in the lower four miles of Gazos Creek (Smith 2013). However, high flows in 2011 and 2012 shifted and partially redistributed the wood within the log jams, improving access for adult steelhead and contributed to higher juvenile steelhead densities (28-30 fish per 100 feet), but densities of age 0+ steelhead were still lower than 1992-2005 mean of 41 fish per 100 feet (Smith 2013). The stream has relatively abundant large wood, and yearling densities have remained relatively high despite the lower age 0+ densities.

San Vicente Creek. San Vicente Creek drains approximately 11 square miles of the Santa Cruz Mountains in western Santa Cruz County and encompasses one primary subwatershed, Mill Creek. San Vicente Creek enters the Pacific Ocean at the town of Davenport about 10 miles north of the City of Santa Cruz. There are approximately 4.5 miles of potential habitat for steelhead in the San Vicente Creek watershed.

Shapovalov and Taft (1954) noted the size of the adult steelhead run in San Vicente Creek was smaller than those observed in neighboring Scott or Waddell creeks. During the winter of 2011-12, Jankovitz (2012) conducted redd surveys throughout the anadromous portion of San Vicente Creek and observed 55 steelhead redds for a density of 9.07 steelhead redds per kilometer. During the winter of 2012-13, 76 steelhead redds were observed throughout the anadromous portions of the San Vicente watershed which equated to a redd density of 24.8 redds per kilometer; all redds were found in the mainstem of San Vicente Creek (Jankovitz 2013).

In 1996, juvenile steelhead were relatively abundant at seven sites sampled across the 3.4 miles of accessible habitat (CDFG 1996) and in October 2001, 37 pools throughout 3.4 miles of creek produced 422 juvenile steelhead, of which 290 were Age 0+ (Nelson 2001). In recent years, biologists from NMFS's Southwest Fisheries Science Center have observed juvenile steelhead throughout San Vicente Creek.

Laguna Creek. Laguna Creek drains approximately 8.2 square miles of the Santa Cruz Mountains in western Santa Cruz County and encompasses the subwatersheds of Reggiardo Creek and several smaller unnamed streams. Laguna Creek enters the Pacific Ocean approximately six miles northwest of the City of Santa Cruz. A natural waterfall limits available potential habitat to approximately 2.8 miles. A small lagoon connected to a large backwater pond exists at the creek mouth (HES 2012).

Shapovalov and Taft (1954) described the adult steelhead run size in Laguna Creek as smaller than in Scott and Waddell creeks, but did not provide a size estimate. Following a survey in early 1960, CDFG noted that Laguna Creek supported a "small run of steelhead rainbow trout," and that the lower portion of the creek below a series of natural, impassable waterfalls provided "very poor" spawning habitat; a major limiting factor in the watershed (Titus *et al.* 2010). In 1981, *O. mykiss* were observed at relatively high densities at five sites (about 70 fish per 100 feet); the report also noted significant water diversions were the primary limiting factor affecting the population. Age 0+ and older fish were present during surveys in 1985 below the lower waterfall, but no abundance estimates were made. In the lagoon, summer and fall juvenile steelhead surveys have been conducted annually since 2008 and in 2004 and 2005 (HES 2012). Juvenile steelhead were found during each sampling event in relatively low numbers; however growth rates in the lagoon

were very good. Based on 2005 population estimates generated from lagoon sampling, the City of Santa Cruz (2011) estimates the lagoon has the potential to produce 675 smolts. Conservatively, that number of smolts may produce an adult population estimate of 60 fish, 90 percent of which may have reared in the lagoon.

History of Land Use, Current Resources and Land Management

San Pedro Creek. Early land uses in San Pedro Creek included cattle ranching and agriculture. By the early 20th century, much of the mainstem was channelized, and the extensive estuary and wetlands near the coast had largely been drained for agricultural production (Culp 2002, Davis 2004). Beginning in the 1950s, agriculture was replaced by extensive suburban and commercial developments as part of the City of Pacifica (now approximately 36 percent of the watershed area). A major consequence of the urbanization for steelhead was the entire loss of the North Fork channel and its tributaries, which were placed in large underground culverts (Amato 2003, McDonald 2004). The Middle Fork and South Fork, which consist of mostly coastal shrub, mixed evergreen and Eucalyptus forests, and willow/alder riparian woodland, are protected in San Pedro Valley County Park

Tunitas Creek. The upper Tunitas Creek watershed drains steep, mountainous terrain covered largely in second-growth coast redwood and mixed conifer forests. At lower elevations, the terrain is less steep, and vegetation consists mostly of coastal shrub and grasslands with alder-willow riparian forests along the creeks. In addition to logging, other historic land uses included cattle grazing and dry farming. More recently, very little logging has occurred with about 1 percent of the watershed area included in a timber harvest plan over the last 10 years. Residential development remains low with approximately 170 people living in the watershed. Debris from logging in the upper watershed resulted in many log debris jams that were noted as impediments to fish migration over the years (Shapovalov 1939, CDFG 1962, CDFG 1964, Titus *et al.* 2010). Logging, road construction on the steep, erodible hill slopes, and cattle grazing have all impaired substrate quality in the watershed. Several wells and flow diversions were observed during a habitat assessment of the watershed in 2006 (J. Nelson, CDFW, personal communication, August 2013). The Midpeninsula Regional Open Space District owns and manages the approximately 700-acre Tunitas Creek Open Space Preserve, which borders portions of both Tunitas and East Fork Tunitas creeks.

Gazos Creek. Gazos Creek flows through deep canyons developed in fractured mudstones of the Santa Cruz Formation, which sustains seepage of cool waters during the dry season. The hill slopes and interior valleys are a mixture of coast redwood and Douglas fir forests. At lower elevations near the coast, coastal shrub, grasslands and a small amount of agricultural lands are

present. Approximately 80 percent of the watershed is privately owned, yet residential developments are few. The remainder of the watershed is owned by State Parks. By 1955, CDFG noted the watershed had suffered significant damage from extensive logging during the early half of the century (Titus *et al.* 2010). Accumulations of fine sediments were impacting habitat quality throughout the watershed, including the lagoon. Logging still occurs in the watershed with approximately 11 percent of the watershed within a timber harvest plan over the last 13 years. Old Woman's Creek, and its extensive road network, remains a significant contributor of fine sediments to lower Gazos Creek (Alley 2003, Nelson 1994, Smith 2013). The sediment originating from Old Woman's Creek continues to have an adverse effect on the production of steelhead in Gazos Creek downstream of their confluence. Log jams have been noted as a significant problem for fish passage in Gazos Creek since extensive logging began in the upper watershed (CDFG 1964, CDFG 1978, CDFG 1984, Nelson 1994, and Smith 2013). Water diversion for agricultural areas near the coast and minor rural residential use has also been identified as a limiting factor (Nelson 1994, Alley 2003). The lagoon at the mouth of Gazos Creek is shallow and usually open in summer, possibly because the closed lagoon inundates a septic tank upstream of Highway 1 (Smith 2013).

San Vicente Creek. The San Vicente Creek watershed drains through steep karst (limestone) geology, which also provides a source of cool water during the dry season. About 60 percent of the watershed consists of coniferous forest, much of which is upstream of anadromy and about 30 percent of the watershed is either shrubland, montane, or riparian hardwood forest. Historically, logging, ranching, and mining (limestone) were the primary industries in the watershed[1]. Land use in the watershed today includes rural residential, forestry, commercial (Town of Davenport) and quarrying. Logging continues with about 22 percent of the San Vicente Creek watershed under a timber harvest plan over the last 10 years. Approximately 99 percent of the watershed is in private ownership and the remaining one percent is state-owned forest lands. Housing development is moderate to low with approximately 450 housing units mostly in the Town of Davenport. The Trust for Public Land recently purchased the property owned by Coast Dairies most of which has subsequently been turned over to State Parks and BLM. In 2011, a significant portion of San Vicente's headwaters were permanently protected as part of the CEMEX Redwood purchase. Since 2011, the property, now named San Vicente Redwoods, has been owned and managed by the Living Landscape Initiative, a consortium of local and national conservation groups, including Peninsula Open Space Trust, the Land Trust of Santa Cruz County, The Nature Conservancy, the Save the Redwoods League, and the Sempervirens Fund.

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[1] Coast Dairies Property: A Land Use History: available at: http://www.santacruzpl.org/history/articles/381/

Laguna Creek. The Laguna Creek watershed drains relatively steep terrain consisting of weathered granite and karst geology in the upper watershed that provide a source of cool stream flow during summer. About 60 percent of the watershed consists of coast redwood, ponderosa pine, or Douglas fir forests. Areas near the coast are largely coastal shrub and grasslands with a small amount of urban area and agriculture. Approximately 91 percent of the watershed is privately owned while the remainder is managed by CDFW as part of the Bonny Doon Ecological Reserve. Logging is minor with only 39 acres covered in a timber harvest plan over the past 15 years. Rural residential is moderate with 463 residences throughout the watershed accounting for about 1,000 people. The City of Santa Cruz owns and executes a pre-1914 water right at two streamflow diversion facilities on Laguna Creek (City of Santa Cruz 2011). Impaired streamflows are the primary limiting factor in the watershed for steelhead (Becker and Reining 2008). More recently, the City of Santa Cruz has increased bypass flows which has improved stream flow to lower Laguna Creek and the lagoon.

Conditions

Current impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on the conditions is abated. The following discussion focuses on those conditions that rated as a High or Medium effect to steelhead life history stages (See Santa Cruz Mountains Diversity Stratum Rapid Assessment Stresses Results). Within these five populations, major conditions were associated with Estuary: Quality & Extent, Habitat Complexity: Large Wood & Shelter, and Sediment: Gravel Quality & Distribution of Spawning Gravels. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and functioning watershed processes.

Estuary: Quality & Extent

Of the five populations, San Pedro and San Vicente have experienced the most significant loss in the extent and quality of their estuarine habitats. In San Pedro, more than 98 percent of the lagoon and adjacent wetlands were permanently lost following urbanization of the valley floor in the 1950s. The remaining fraction of estuarine habitat (some of which was the result of a recent habitat enhancement project) still provides valuable rearing and saltwater acclimation habitat for steelhead. During the construction of the Ocean Shore Railway in 1906, lower San Vicente Creek was routed through a bedrock bore tunnel at the north end of the beach, and much of its estuary was filled to support the new railroad trestle. Additional fill was added during the construction of Highway 1 in the 1930s. For Tunitas, Gazos, and Laguna creeks, the lagoons are primarily impacted by upstream flow diversions which reduce freshwater inflow and can impair lagoon water volume/depths, water quality, and productivity. Illegal and sometimes frequent sandbar

breaching also occurs, further limiting their suitability as summer and winter-rearing habitat for juveniles and saltwater transition habitat for smolts in spring.

Threats that contribute to this condition and continue to impair steelhead include Disease, Predation, and Competition, Channel Modification, Recreational Areas and Activities (*i.e.*, breaching), Residential and Commercial Development, and Water Diversions and Impoundments.

Habitat Complexity: Large Wood & Shelter

Reduced large wood and shelter was rated as High for its effect for winter-rearing juveniles, as Fair for summer-rearing juveniles, and as Good for the adult and smolt lifestages. According to Stillwater Sciences *et al.* (2010), streams in the Santa Cruz Mountains contain little of the low-gradient, wide-valley streams capable of providing productive off-channel rearing habitat for salmonids. Therefore the presence of large wood in these steeper streams is essential for providing the types of refuge habitat during high flow events. With the exception of San Pedro Creek, most of the watersheds in the diversity stratum support extensive areas of conifer forests. Large wood is moderately abundant in portions of the anadromous reaches of Tunitas and Gazos creeks, but relatively scarce in San Vicente and Laguna creeks. Recent field surveys in San Pedro Creek indicate that suitable overwintering habitat in the form of undercut banks, boulder clusters, and accumulations of smaller woody debris is common in the Middle Fork and upper mainstem, but less abundant in the steeper South Fork.

Sediment: Gravel Quality & Distribution of Spawning Gravels

Impaired gravel quality and quantity was rated as High for effects on the egg lifestage and as Fair for summer and winter-rearing juvenile lifestages. Excessive fine sediment has compromised rearing and spawning habitat in these populations to varying degrees. Accumulations of fine sediment have reduced residual pool volumes, and increased substrate embeddedness. Increased potential for redd scour is also a concern in some reaches for all five of these populations. Threats that contribute to this condition and continue to impair steelhead include Roads and Railroads, Channel Modification, Residential and Commercial Development, and Severe Weather Patterns.

Conditions Rated as Fair or Good

Riparian Vegetation: Composition, Cover & Tree Diameter

This conditions was rated as Good for summer-rearing steelhead in these populations, although the presence of non-native and invasive species, such as eucalyptus, cape ivy, and periwinkle, within the riparian zones of these streams is fairly common, and if expanded they could

compromise the health of riparian habitats. For example, summer baseflow may decline with future climate change. In streams with large infestations of Tasmanian bluegum (*Eucalyptus globulus*), further reductions in flow and flow duration may occur because of the higher water demand of *E. globulus* relative to native riparian species. Left unmanaged, Cape ivy (a parasitic species) will eventually kill mature riparian trees that provide shade and sources of LWD to the stream. Conversion from previously deciduous hard wood riparian forests (i.e., alder/willow) to evergreen forest (evergreen or acacia) would reduce light availability, instream productivity, and fish feeding efficiency; particularly during early spring when rapid growth of yearling steelhead is important.

Velocity Refuge: Floodplain Connectivity

Floodplain connectivity was rated as Good for its effect on steelhead adults and smolts and as Fair for winter-rearing juveniles in these populations. As noted above, low-gradient streams with accessible floodplain habitats and backwater features are naturally rare in the Santa Cruz Mountain Diversity stratum (Stillwater Sciences *et al.* 2010). The few areas where these habitats historically existed have largely been developed for urban or agricultural uses (e.g., mainstem San Pedro Creek and lower Laguna Creek). Threats that contribute to this condition and continue to impair steelhead (primarily winter-rearing juveniles) include: Channel Modification, Residential and Commercial Development, and Roads and Railroads.

Hydrology: Redd Scour

This condition was rated as Fair for steelhead egg survival. Substrate quality has been degraded in portions of all five populations. The large extent of impervious surfaces (San Pedro Creek), naturally entrenched channels (portions of all populations), and parent rock material with lower specific gravity such as Santa Cruz mudstone (Tunitas and Gazos) create conditions that are conducive to gravel scour events. Past channelization projects and stream maintenance programs intended to reduce channel roughness and flooding have increased the potential for redd scour in some of these systems. Encouraging implementation of projects to increase channel complexity (i.e., widening channels, adding structures and gravel sorting features) will help reduce this threat in the future. Threats that contribute to this condition and continue to impair steelhead include: Channel Modification, Residential and Commercial Development, and Severe Weather Patterns.

Hydrology: Baseflow and Passage Flows

This condition was rated as Fair for its effect on summer-rearing juvenile steelhead, as Good for adults and smolts, and Very Good for eggs. Flow diversions during the dry season have been identified as a problem in Tunitas, Gazos, and Laguna creek. With the exception of Gazos, the remaining watersheds have relatively low natural baseflows. Summer baseflows in Gazos Creek

are relatively high because of the fractured shale in the upper watershed. The addition of surface or groundwater diversions in these watersheds has had reach-level, if not watershed-level, impacts on baseflow flow volumes that can impact all lifestages and habitats, including downstream estuaries. Threats that contribute to this condition and continue to impair steelhead include: Severe Weather Patterns (*i.e.,* droughts) and Water Diversions and Impoundments.

Passage/Migration: Mouth or Confluence & Physical Barriers

This condition was rated as Fair for its effects to adults and Good or Very Good for juveniles and smolts in these watersheds. Multiple passage impediments or complete barriers have been identified in the San Pedro Creek, Gazos, and San Vicente Creek watersheds. However, with the exception of San Vicente, the amount of suitable habitat upstream of these barriers is limited. There are multiple culverts on the mainstem of San Pedro Creek that are considered partial impediments to adults and juveniles during periods of low flow. In Tunitas and Gazos creeks, multiple historical and contemporary records indicate large log/debris jams have caused problems for steelhead passage. Streamflow diversions can also impact steelhead adult and smolt migration windows. For example, flow diversions in Laguna Creek by the City of Santa Cruz (under their Tier II and III bypass flow targets) reduce the number of adult passage days by 25 to 30 percent relative to no diversion levels (City of Santa Cruz 2011). Threats that contribute to this condition and continue to impair steelhead include Channel Modification, Residential and Commercial Development, Roads and Railroads, Severe Weather Patterns, and Water Diversions and Impoundments.

Water Quality: Turbidity or Toxicity

Water Quality: Turbidity or Toxicity was rated as Good for steelhead adults and smolts and as Fair for summer-rearing and winter-rearing juveniles in these populations. In San Pedro, discharges of various pollutants to the creek via the urban storm drain network have impacted all steelhead lifestages. Specifically, discharges of swimming pool water, concrete slurry, and other pollutants originating from the North Fork and mainstem have been reported; some of these discharge events have resulted in fish kills including adults. Elevated turbidity originating from unpaved roads, channel maintenance activities, and other land uses was rated as Fair for winter-rearing juveniles in these watersheds.

Threats

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

Channel Modification

Stream channels in these populations have been modified by channel straightening, removal of instream structure, levee construction, channel filling, rerouting, and bank stabilization to reduce flood risk and protect roads and other infrastructure. The degree of channel modification and associated impacts varies across the populations but is most pronounced in San Pedro Creek, where nearly the entire mainstem has been rerouted, straightened, and lined by suburban and commercial developments. In addition, the entire North Fork tributary was piped into underground culverts and more than 98 percent of the historic estuary and lowland wetlands were drained and development. Maintenance efforts to protect roads constructed within, or immediately adjacent to, riparian areas (e.g., Gazos Creek Road or Tunitas Creek Road) will continue into the future because these roads serve as main thoroughfares for rural residences in these drainages.

Disease, Predation and Competition

As noted above, reduced depth and volume during the rearing and smolt outmigration phases can increase competition and predation rates. The reduced escape and overhead cover concentrates fish into smaller areas with less shelter thereby leaving them more vulnerable to predation. Habitats already impacted by other conditions, such as a lack of channel complexity or accumulations of fine sediments, further magnifies the risks of increased competition and predation.

Fire, Fuel Management and Fire Suppression

Wildfires are likely to occur in these watersheds in the future. A major fire, particularly if located in areas with a high erosion potential, could substantially increase fine sediment input and further compromise the altered rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures would likely result. Watersheds with large and widespread infestations of highly flammable eucalyptus trees (e.g., San Pedro Creek), have an elevated risk of significant fire damage and sediment erosion potential.

Recreational Areas and Activities

Hiking is a common form of recreation in these watersheds. While unpaved trails have the potential to deliver sediment to streams, existing trails in these watersheds are not considered a major source of fine sediment. The use of beaches for activities, such as swimming, sunbathing, surfing and fishing, are also popular. Tunitas, Gazos, and Laguna creeks all have seasonal lagoons that develop once a sandbar forms in summer. Illegal breaching of the sandbars can significantly affect the health and function of these lagoons and their ability to provide critical rearing and saltwater transition habitat for steelhead.

Residential and Commercial Development

Past residential and commercial development is responsible for the loss of extensive estuarine and riparian habitats in the San Pedro Creek Watershed. Smaller developments in the other populations have resulted in minor losses to the extent of estuarine and riparian habitats. Other consequences of past developments to the watershed landscape include: channelization and simplification of stream habitats, impairments to the hydrology and bank erosion caused by increased impervious surfaces, occurrences of toxic discharges and increased turbidity, and in most cases, utilization of local water resources.

Roads and Railroads

Road densities in the five watersheds are considered moderately high to high with densities ranging from 1.6 to 4.5 miles of road per square mile of watershed area, and at 1.9 to 6.7 miles per square mile of riparian area. Some of these roads are poorly situated, unpaved, and serve as sources of chronic sediment input (e.g., Old Womans Creek Road in the Gazos Creek Watershed). Paved and unpaved roads parallel many of the streams and limit natural channel migration. The construction of Highway 1 and the Ocean Shore Railroad in northern Santa Cruz County are responsible for complete (San Vicente) and partial (San Pedro, Gazos, and Laguna) filling of historic estuarine habitats. Paved roads within the urbanized portion of the San Pedro Creek watershed constitute a substantial area of impervious surfaces and a highly efficient conduit for storm water and pollutant runoff.

Severe Weather Patterns

Large flood events and droughts have adversely impacted steelhead populations and their habitats throughout the stratum. Each of the watersheds discussed in this assessment are impacted by existing threats such as high residential and commercial development, water diversions and impoundments, or even legacy effects from historic management of the landscapes (e.g., clear cut logging and road construction), which makes them less resilient to future severe weather events. Improved land use planning and management practices, restoration projects, and more efficient water use, will help reduce the threat of severe weather events on steelhead and their habitats in these systems.

Water Diversion and Impoundments

Aquatic habitats have been adversely impacted in each of these populations by water diversions to some degree. San Pedro Creek has been the least impacted because all or most of the water resources utilized in the watershed are imported (i.e., Crystal Springs Reservoir)[2]. The remaining

[2] The North Coast County Water District has a water right for a diversion of 500 gallons per minute (gpm) from San Pedro Creek between December 1 and April 30, and 210 gpm during May. However, minimum

populations all rely on local sources of water, or also serve as a major water source for nearby cities (i.e., the Laguna Creek diversions for the City of Santa Cruz). Flow diversions adversely impact nearly all steelhead lifestages by reducing habitat availability, suitability, and migration success. Estuaries are also impacted by upstream diversions. Where diversion rates are high (e.g., Laguna Creek), lagoon volume, depth, and the percentage of freshwater inflow can be adversely affected, which creates less optimal (or unsuitable) habitat conditions for steelhead rearing and survival.

Fishing and Collecting

This threat is rated as a Low or Medium contributor to the conditions in these populations.

Hatcheries and Aquaculture

This threat is rated as a Low or Medium contributor to the conditions in these populations.

Limiting Conditions, Lifestages, and Habitats

Winter-rearing steelhead is the lifestage most limited by current conditions and future threats in San Pedro, Tunitas, Gazos, San Vicente, and Laguna creeks. Impaired estuary quality and extent, impaired substrate conditions for spawning and rearing, and impaired habitat complexity are the most limiting habitat attributes. Channel Modification, Recreational Areas and Activities (i.e., illegal lagoon breaching), Roads and Railroads, Severe Weather Patterns, and Water Diversions and Impoundments are the most significant future threats for these populations.

General Recovery Strategy

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

Improve and Protect Estuarine Habitats

Estuaries play an import role in the lifecycle of steelhead. When healthy lagoons and estuaries are biologically rich environments, they provide a transitional environment where steelhead can adjust to saltwater in preparation for life in the marine environment. The estuaries or lagoons in

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instream flow volumes required by CDFW substantially limit the amount of water the District can divert. The District's treatment facility has been inoperable since 1997 and no diversions have occurred since then or are likely to in the near future (Donaldson 2011).

each of these populations have been impacted by various threats; however, few complete studies on these habitats have been conducted to determine precise limiting factors for steelhead. Some of the estuaries have experienced dramatic declines in their extent, including complete loss. Meanwhile reduced freshwater inflow and sedimentation limit the volume of habitat available and impairs water quality necessary for maintaining rich productivity. Comprehensive studies in each of these lagoons should be conducted over time to determine limiting factors and their use by steelhead. Installation of interpretive signs at each lagoon that outline the benefits of lagoons to salmonids and other sensitive species and the legal implications for breaching must also occur. Also, increased patrols by law enforcement during periods of sandbar closure and high lagoon water elevation are necessary to prevent breaches. Finally, assessing the potential for the expansion of estuary extent in the populations where a significant loss of historic extent has occurred should be done.

Improve Habitat Complexity

Reduced habitat complexity is a current limiting factor in these watersheds. Restoration actions should focus on retaining instream LWD and improving spawning habitat through the placement of habitat structures that can effectively increase holding and rearing habitat and help with sorting of gravels. In stream reaches with little immediate downstream infrastructure, properly-sized trees could be felled into stream channels to create these structures. Overwintering habitat enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should be implemented and designed to provide cover, and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions.

Address Upslope Sediment Sources to Improve Gravel Quality and Quantity

Accumulations of fine sediments are a problem in each of the above populations. Active and abandoned logging roads are located in some of the watersheds. Restoration actions targeted at reducing or eliminating sources of fine sediments are important for improving existing conditions. Sites known as significant sediment sources that have a significant impact on steelhead habitat should receive the highest priority. Furthermore, future road maintenance work should include measures to close and decommission unnecessary or abandoned roads. At a minimum, use of unpaved roads during winter should be highly restricted and appropriate measures should be taken during the dry season to reduce or eliminate sources of sediment. Bank erosion caused by past channel modification projects also contribute fine sediments. Planting of riparian vegetation where banks are bare and implementation of restoration projects aimed at reducing runoff rates or protecting banks using bioengineered methods should receive high priority in areas where this condition is occurring.

Ensure Protective Flows Are Maintained

Water diversions have been identified as a High threat to these populations because of their growing populations and relatively low summer baseflows. Adoption, implementation, compliance monitoring and enforcement of standards set forth by CDFW (CDFG 2008) should ensure flows protective of all steelhead lifestages are met. Increased implementation of off-channel storage and rainwater harvest facilities would help reduce dry season diversions, particularly in rural areas that rely on local streams as the water source.

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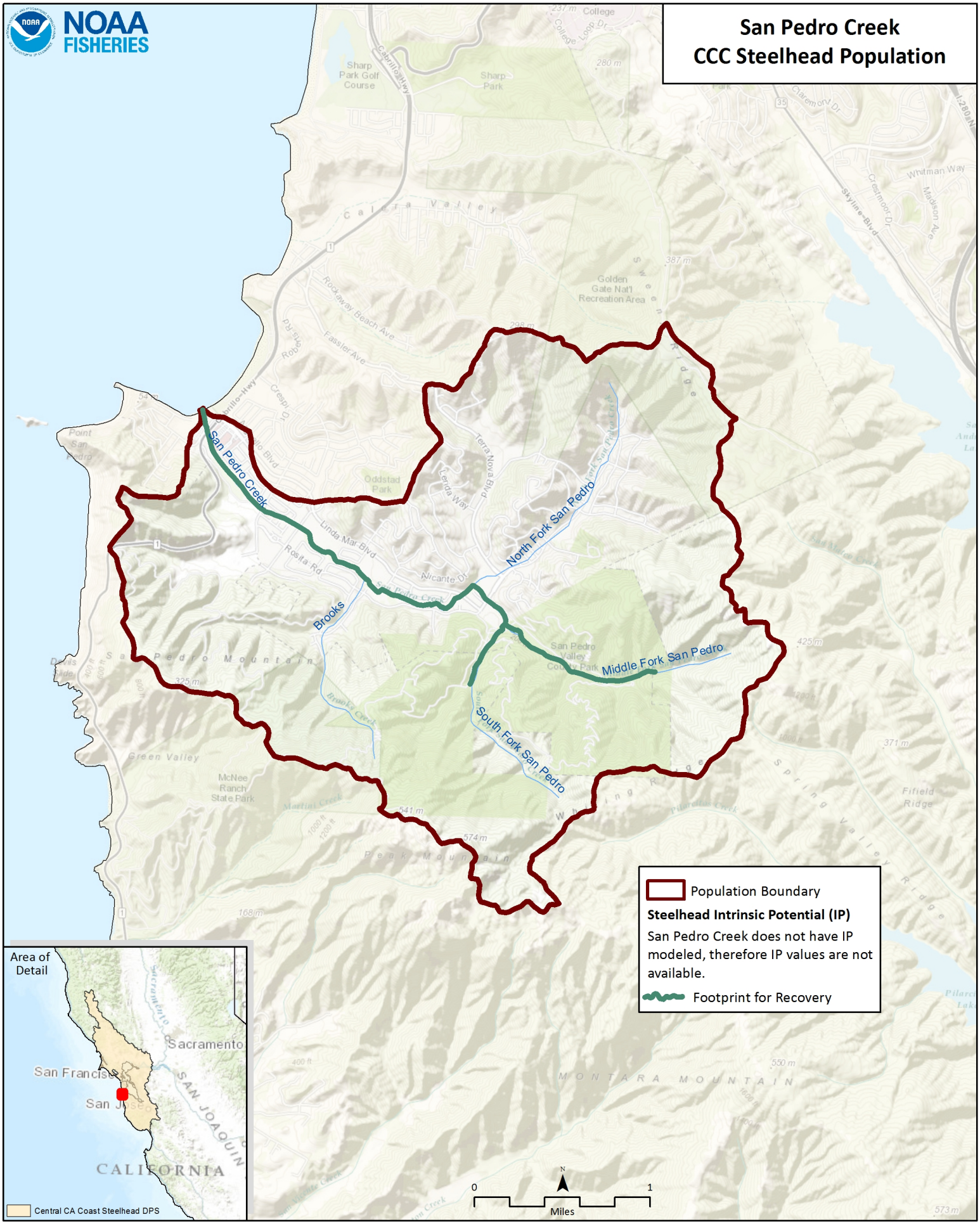
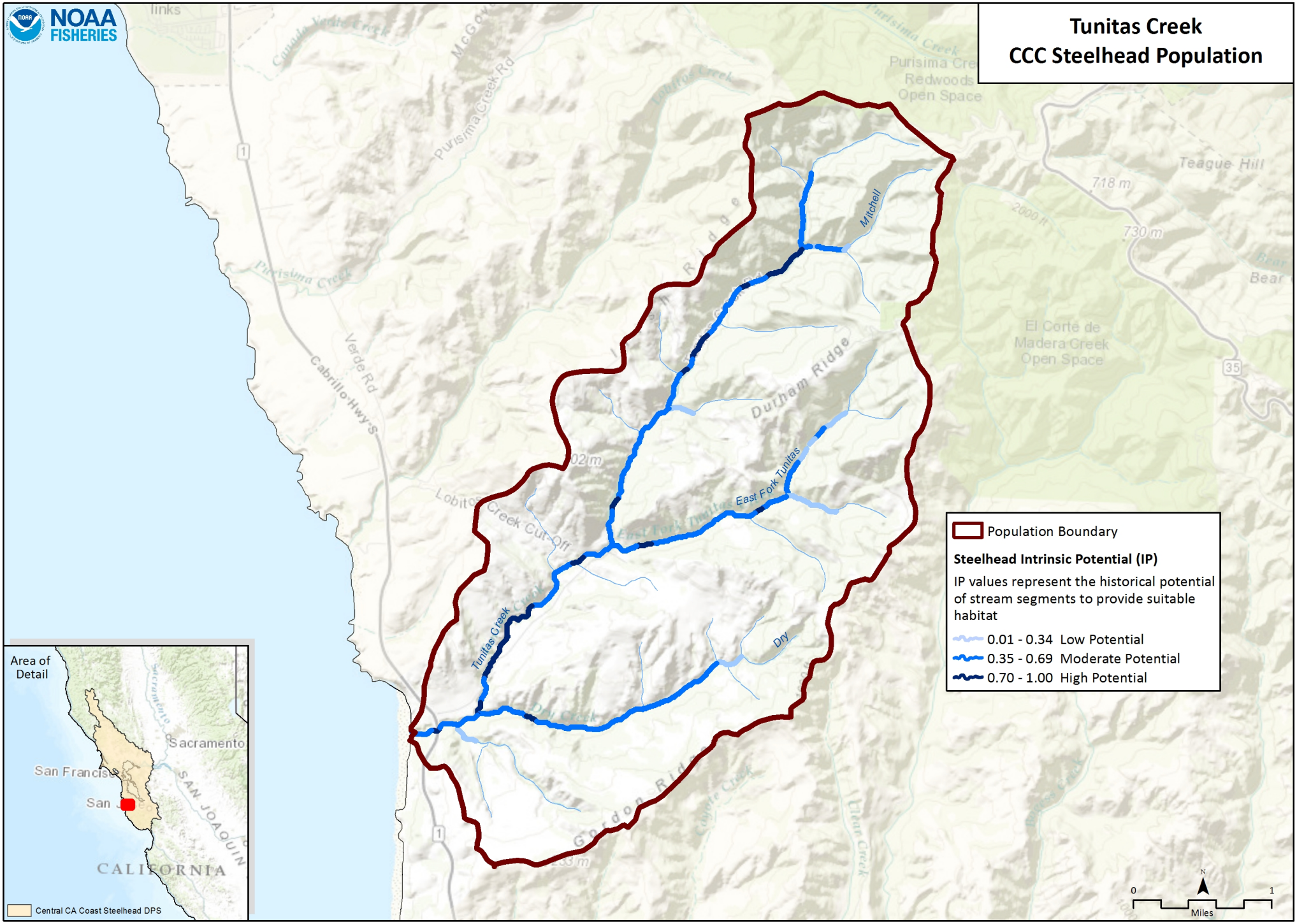
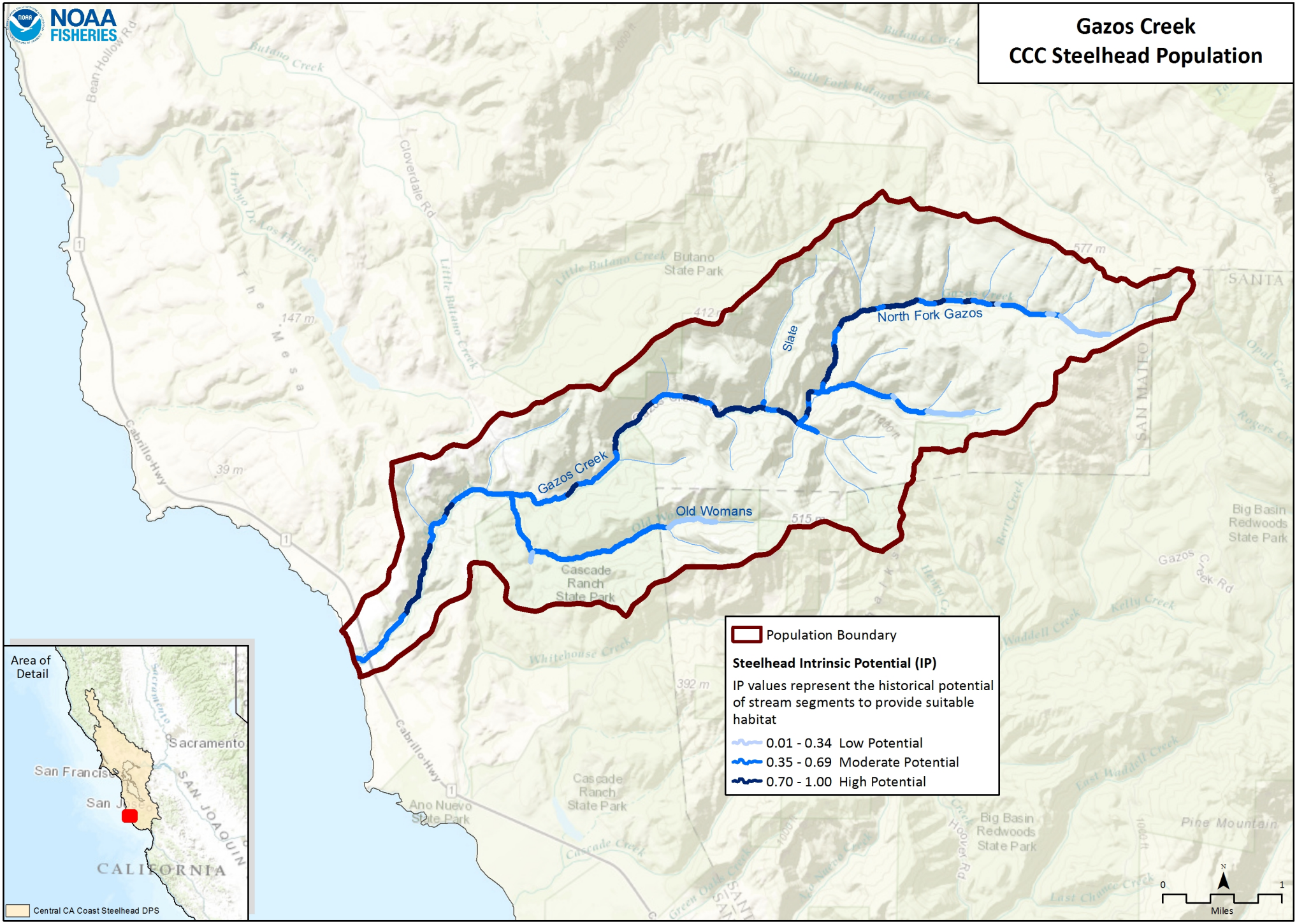
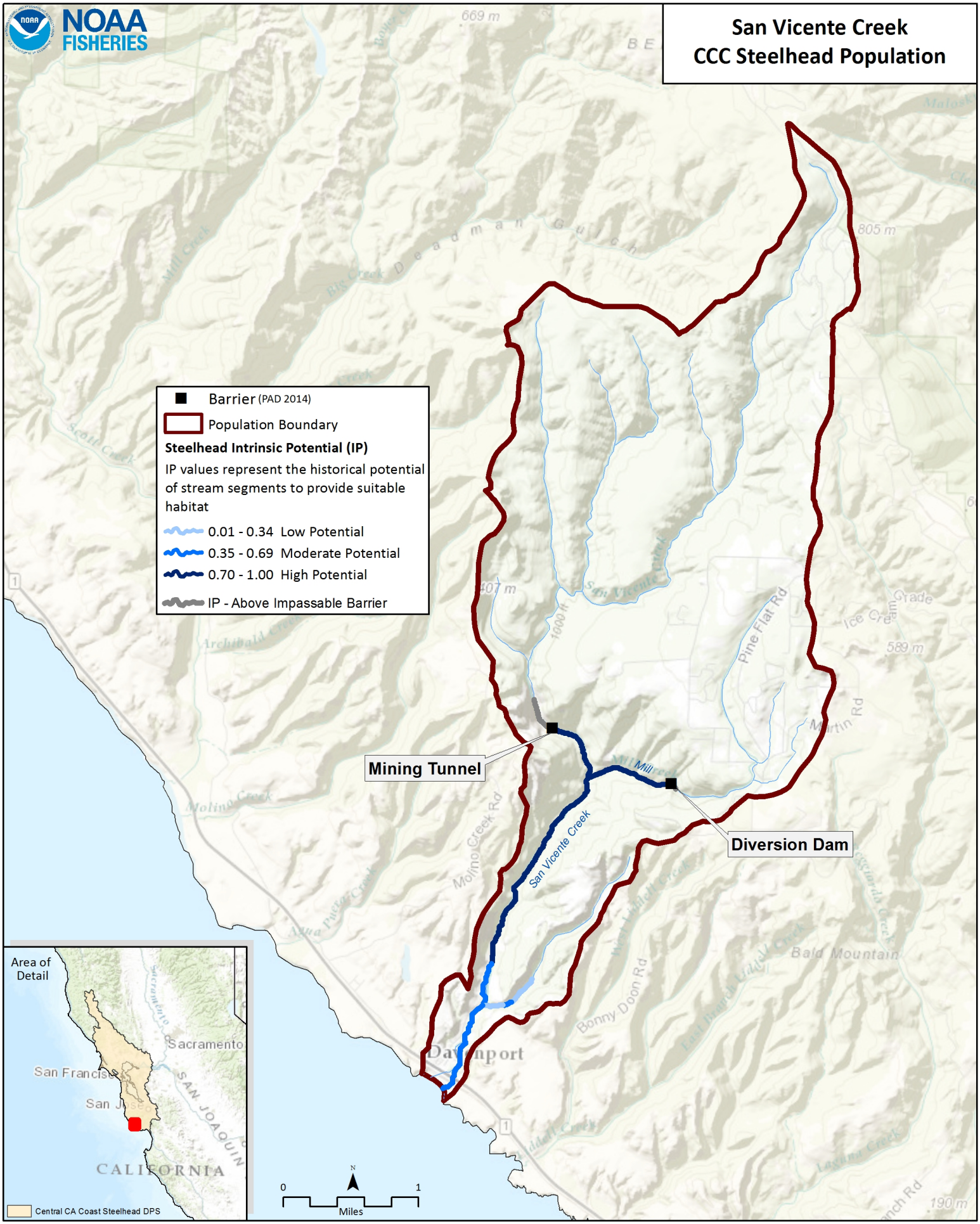
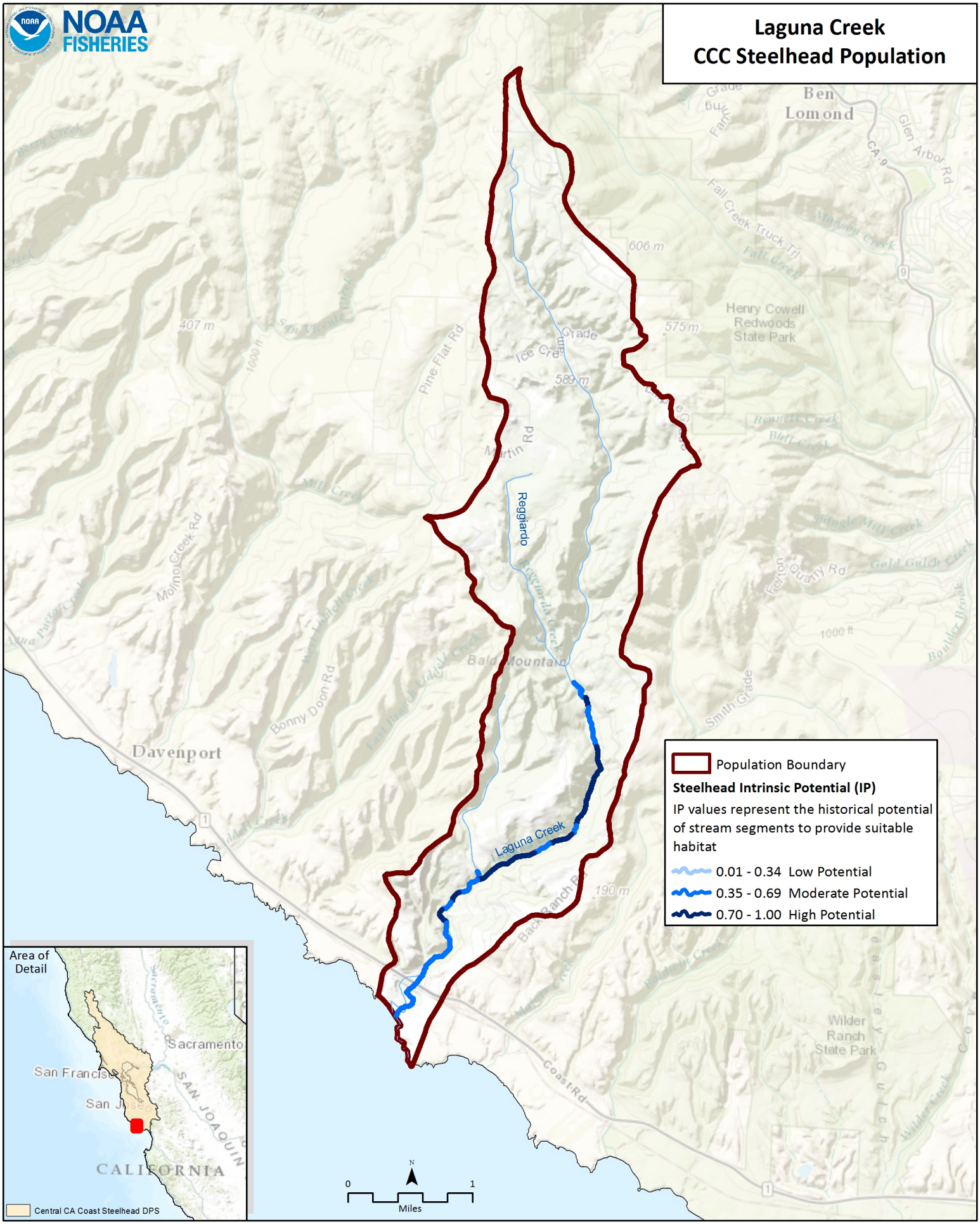

NOAA FISHERIES
San Pedro Creek
CCC Steelhead Population
San Pedro Creek
Brooks
North Fork San Pedro
Middle Fork San Pedro
South Fork San Pedro
Population Boundary
Steelhead Intrinsic Potential (IP)
San Pedro Creek does not have IP modeled, therefore IP values are not available.
Footprint for Recovery
Area of Detail
Sacramento
San Francisco
San Jose
CALIFORNIA
Central CA Coast Steelhead DPS
0
1
Miles


Tunitas Creek
CCC Steelhead Population
NOAA FISHERIES
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Sacramento
San Francisco
CALIFORNIA
Central CA Coast Steelhead DPS
Tunitas Creek
East Fork Tunitas
Mitchell
Dry
Durham Ridge
Lobitos Creek Cut-Off
Purisima Creek
Purisima Creek Rd
Cabrillo Hwy S
Verde Rd
Teague Hill
El Corte de Madera Creek Open Space
Redwoods Open Space
Gordon Ridge
Miles


Gazos Creek
CCC Steelhead Population
NOAA FISHERIES
Gazos Creek
North Fork Gazos
Slate
Old Womans
Butano State Park
Cascade Ranch State Park
Big Basin Redwoods State Park
Ano Nuevo State Park
Cabrillo Hwy
Cloverdale Rd
Bean Hollow Rd
Gazos Creek Rd
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
Sacramento
San Francisco
San Jose
SAN JOAQUIN
CALIFORNIA
Central CA Coast Steelhead DPS
0
1
Miles
N


NOAA FISHERIES
San Vicente 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 Barrier
Mining Tunnel
Diversion Dam
San Vicente Creek
Mill Creek
Pine Flat Rd
Molino Creek Rd
Bonny Doon Rd
Bald Mountain
Davenport
Area of Detail
Sacramento
San Francisco
San Jose
SAN JOAQUIN
CALIFORNIA
Central CA Coast Steelhead DPS
0
1
Miles
N


NOAA FISHERIES
Laguna 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
Laguna Creek
Reggiardo
Davenport
Ben Lomond
Henry Cowell Redwoods State Park
Wilder Ranch State Park
Bald Mountain
Area of Detail
Sacramento
San Francisco
San Jose
CALIFORNIA
Central CA Coast Steelhead DPS
0
1
Miles

CCC Steelhead DPS: Santa Cruz Mountains Diversity Stratum (San Pedro/Gazos/San Vicente/Laguna/Tunitas)

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

CCC Steelhead DPS: Santa Cruz Mountains Diversity Stratum (San Pedro/Gazos/San Vicente/Laguna/Tunitas)

Threat Scores
L: Low
M: Medium
H: High

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

San Pedro Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SPC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
SPC-CCCS-1.1.1.1	Action Step	Estuary	Conduct a feasibility study of potential strategies to increase the current extent of the San Pedro Creek Lagoon/Estuary in efforts to increase high value habitat for migrating and rearing steelhead.	3	5	California Coastal Conservancy, CDFW, City of Pacifica, County of San Mateo, NMFS, NOAA RC, San Mateo County RCD, The Nature Conservancy, Trout Unlimited, USACE, USFWS	322.00					322	Cost based on estuary use/residence time model at a rate of $321,745/project.
SPC-CCCS-1.1.1.2	Action Step	Estuary	Develop and implement a lagoon habitat assessment program to determine the quality and function of the San Pedro Creek Lagoon/Estuary as well as seasonal steelhead use and abundance over time.	2	5	CDFW, City of Pacifica, NMFS, Private Consultants						TBD	The habitat assessment should determine existing limiting factors and develop potential rehabilitation projects to address these factors. Cost accounted for in above action step.
SPC-CCCS-1.1.1.3	Action Step	Estuary	Expand the use of gull-proof lids on refuse cans at and around the lagoon and beach.	2	5	California Coastal Conservancy, City of Pacifica, County of San Mateo, Private Landowners						0	Cost expected to be minimal and part of ongoing improvements. Action is considered In-Kind
SPC-CCCS-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
SPC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Work with landowners to identify suitable locations for implementing channel widening and riparian habitat enhancement projects aimed at improving floodplain connectivity and overwintering habitat. Identify sites where channel widening along the mainstem of San Pedro Creek would be feasible and develop conceptual plans for enhancements.	3	25	CDFW, City of Pacifica, County of San Mateo, FEMA, NMFS, Private Landowners, Trout Unlimited, USACE						0	Potential locations may include undeveloped fields adjacent to Sanchez Adobe County Park and Alma Heights School (SPCWC 2002), and open space areas adjacent to the Sanchez Art Center (immediately upstream of the Sanchez Fork confluence). Action is considered In-Kind
SPC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
SPC-CCCS-3.1.1.1	Action Step	Hydrology	Develop and implement actions to capture, detain, and/or percolate stormwater runoff locally to reduce redd scour, bank erosion, channel incision, and sedimentation in the mainstem of San Pedro Creek.	2	10	CDFW, City of Pacifica, County of San Mateo, NMFS, San Mateo County RCD, SWRCB, USEPA						TBD	High stream flow velocities and volumes exiting the North Fork culvert have substantially increased bank erosion and the delivery of fine sediments to the mainstem. See SPCWC (2002). Cost based on amount of catchment basins needed and landowner participation.

San Pedro Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SPC-CCCS-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
SPC-CCCS-5.1.1.1	Action Step	Passage	Improve fish passage at select crossings on the mainstem of San Pedro Creek.	2	10	CDFW, City of Pacifica, NMFS, San Mateo County Department of Parks , San Mateo County RCD	1,063	1,063				2,126	Sites/culverts in order of decreasing importance are Oddstad Road, Linda Mar Boulevard, and Adobe Road. Passage improvements may include replacing existing box culverts with new free spanning bridges or installing enhancements within/downstream of the culverts to reduce peak velocities and increase summer flow depths through the crossing. Cost at each site will vary depending on alternative selected. See also Hagar (2002) and SPCWC (2002). Cost based on providing passage at 5 crossing (4 Temporary, 1 Partial) at a rate of $425,099/project.
SPC-CCCS-5.1.1.2	Action Step	Passage	Evaluate and if necessary enhance fish passage through the concrete box culvert supporting the pedestrian bridge over the Middle Fork San Pedro Creek in San Pedro County Park.	3	5	CDFW, NMFS, San Mateo County Department of Parks , San Mateo County RCD	608					608	If passage enhancement is currently sufficient, re-assess the crossing in 10 years to ensure passage conditions do not deteriorate. See: Hagar (2002) and SPCWC (2002). Cost based on providing fish passage at a rate of $607,284/project.
SPC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
SPC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Promote restoration projects designed to improve instream habitat complexity and overwinter survival for juvenile steelhead in the Middle Fork and mainstem of San Pedro Creek	2	5	CDFW, City of Pacifica, NOAA RC, San Mateo County RCD	32.00					32	Cost based on treating 1 mile (assume 1 project/mile in 50% high IP) at a rate of $31,200/mile.
SPC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Assess the feasibility of enhancing the instream habitat conditions in the lower South Fork San Pedro Creek. This may include removing the levee along the lower left bank and widening the existing channel to improve channel cross-section morphology.	3	10	CDFW, NOAA RC, North County Coast Water District, San Mateo County Department of Parks , San Mateo County RCD	65.50	65.50				131	The existing channel in the lower South Fork is heavily incised and relatively steep due to a major channelization project in the 1960s, which straightened and rerouted the lower reach of the creek to the eastern edge of the valley. Current limiting factors in the anadromous portion of the South Fork (from confluence upstream to the North County Coast Water District diversion) include high flow velocities during storm events, bank erosion, and fine sediment loads; all of which result in a high potential for redd scour. See Pearce et al. (2004). Cost based on fish/habitat restoration at a rate of $130,941/project.
SPC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pool, LWD, and shelters										
SPC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Work with the City of Pacific and San Mateo County Department of Parks to develop and implement an instream large wood retention policy for the Middle Fork, South Fork, and the mainstem San Pedro Creek.	2	20	City of Pacifica, San Mateo County Department of Parks , San Mateo County RCD						0	Action is considered In-Kind

San Pedro Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SPC-CCCS-6.1.2.2	Action Step	Habitat Complexity	Allow native trees in riparian areas to age, die, and recruit into the stream naturally.	2	50	City of Pacifica, County of San Mateo, NMFS, San Mateo County Department of Parks , San Mateo County RCD						0	Action is considered In-Kind
SPC-CCCS-6.2	Objective	Habitat Complexity	Address the inadequacy of existing regulatory mechanisms										
SPC-CCCS-6.2.1	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
SPC-CCCS-6.2.1.1	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	2	25	Caltrans, CDFW, City of Pacifica, County of San Mateo, NMFS, NOAA RC, North County Coast Water District, Private Landowners, San Mateo County RCD, USACE						0	Action is considered In-Kind
SPC-CCCS-6.2.1.2	Action Step	Habitat Complexity	Educate landowners, land managers, and municipal staffs on the importance of LWD to steelhead survival and recovery, and watershed processes.	2	30	CDFW, City of Pacifica, County of San Mateo, NMFS, North County Coast Water District, San Mateo County Department of Parks						0	Action is considered In-Kind
SPC-CCCS-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-7.1.1	Recovery Action	Riparian	Improve riparian conditions										
SPC-CCCS-7.1.1.1	Action Step	Riparian	Remove invasive exotic vegetation from riparian zones.	2	5	Caltrans, City of Pacifica, County of San Mateo, Private Landowners, San Mateo County Department of Parks , San Mateo County RCD	20.00					20	Cost based on treating 0.25 miles (assume 1 project/mile in 5% high IP) at a rate of $984/acre.
SPC-CCCS-7.2	Objective	Riparian	Address the inadequacy of existing regulatory mechanisms										
SPC-CCCS-7.2.1	Recovery Action	Riparian	Improve riparian conditions										

San Pedro Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SPC-CCCS-7.2.1.1	Action Step	Riparian	Develop a non-native-invasive plant management plan for San Pedro County Park with a goal to substantially reduce the extent of Eucalyptus and cape ivy within the Park, particularly within the riparian zones	2	20	San Mateo County Department of Parks , San Mateo County RCD						0	Action is considered In-Kind
SPC-CCCS-7.2.1.2	Action Step	Riparian	Work with the County of San Mateo to revise existing tree ordinances to reduce or waive tree removal permit fees and expedite the tree removal permit process for non-native, invasive tree species (e.g., Eucalyptus and Acacia), particularly in riparian or wetland areas and on public lands when part of a habitat restoration program.	2	20	County of San Mateo						0	Action is considered In-Kind
SPC-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
SPC-CCCS-8.1.1.1	Action Step	Sediment	Reduce anthropogenic sources of fine sediment loading. Where appropriate, use bioengineered practices to stabilize stream banks.	3	10	City of Pacifica, Private Landowners, San Mateo County RCD						TBD	See Pearce et al. (2004)
SPC-CCCS-8.1.1.2	Action Step	Sediment	Develop and implement actions to capture, detain, and/or percolate stormwater runoff to reduce redd scour, bank erosion, channel incision, and sedimentation in the mainstem of San Pedro Creek.	2	10	City of Pacifica, County of San Mateo, Private Landowners, RWQCB, San Mateo County Department of Parks , San Mateo County RCD, USEPA						0	Cost accounted for in other action steps.
SPC-CCCS-10.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-10.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants										
SPC-CCCS-10.1.1.1	Action Step	Water Quality	Where practicable, install vegetated treatment wetlands such as bio-swales, retention basins, and expand the use of permeable pavements throughout the watershed.	2	20	CDFW, City of Pacifica, RWQCB, San Mateo County RCD, State Water Resources Control Board, USEPA, USFWS						TBD	Cost based on amount of feasible methods to employ. Cost estimate for bio-swale ranges between $6,395 to $11,735/project.
SPC-CCCS-10.1.1.2	Action Step	Water Quality	Encourage native and drought tolerant landscaping in order to reduce runoff of chlorinated tap water to storm drain systems that discharge to San Pedro Creek	3	25	City of Pacifica, RWQCB, USEPA						0	Action is considered In-Kind
SPC-CCCS-10.1.1.3	Action Step	Water Quality	Expand education and outreach opportunities to landowners on how to properly dispose of chlorinated swimming pool water, automotive oils and grease, and concrete slurry, and ways to minimize the use of household pesticides and fertilizers	3	20	City of Pacifica, County of San Mateo, RWQCB, San Mateo County RCD, SWRCB, USEPA						0	Action is considered In-Kind

San Pedro Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SPC-CCCS-10.1.1.4	Action Step	Water Quality	Where possible assess the feasibility of day-lighting portions of the North Fork San Pedro Creek channel.	3	10	City of Pacifica, RWQCB, San Mateo County RCD, USEPA						TBD	Cost based on amount of riparian thinning needing to occur. Estimate for riparian thinning is $1,673/acre.
SPC-CCCS-22.1	Objective	Residential/ Commercial Development	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to watershed hydrology										
SPC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	New developments should minimize, changes in duration, or magnitude of peak flow.	2	50	City of Pacifica, USEPA						0	Action is considered In-Kind
SPC-CCCS-22.1.1.2	Action Step	Residential/ Commercial Development	Encourage the use and provide incentives for rooftop water storage and other conservation devices	3	20	City of Pacifica, RWQCB, USEPA						TBD	Cost based on amount of water storage needed and participation of community members.
SPC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SPC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Develop and implement actions to capture, detain, and/or percolate stormwater runoff to reduce redd scour, bank erosion, channel incision, and sedimentation in the mainstem of San Pedro Creek.	2	10	City of Pacifica, County of San Mateo, San Mateo County RCD, State Water Resources Control Board, USEPA						0	Cost accounted for in above action step.
SPC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
SPC-CCCS-23.1.2.1	Action Step	Roads/Railroads	All future or replacement bridges or culverts associated with roads should be free spanning structures or constructed with the minimal amount of impairment to the stream channel.	3	100	Caltrans, City of Pacifica, County of San Mateo						0	Action is considered In-Kind
SPC-CCCS-24.1	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
SPC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to hydrology (gravel scouring events)										
SPC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Develop and implement actions to capture, detain, and/or percolate stormwater runoff to reduce redd scour, bank erosion, channel incision, and sedimentation in the mainstem of San Pedro Creek.	3	20	City of Pacifica, North County Coast Water District, Private Landowners, San Mateo County RCD						TBD	Cost based on amount of storage needed to reduce stormwater impacts.
SPC-CCCS-25.1	Objective	Water Diversion /Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SPC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to watershed hydrology										

San Pedro Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SPC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Work with the North County Coast Water District and other landowners in the San Pedro Creek Watershed to avoid new or increased summer diversions	2	50	CDFW, North County Coast Water District, Private Landowners, SWRCB						0	Action is considered In-Kind
SPC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	Evaluate and implement rainfall capture from impervious surfaces for irrigation use to protect water quality and reduce water demand in summer.	2	50	City of Pacifica, County of San Mateo, NMFS, Private Landowners, San Mateo County RCD						TBD	Cost based on amount of infiltration ponds. Cost estimate for infiltration pond ranges between $12,000 to $35,000/pond.
SPC-CCCS-25.1.1.3	Action Step	Water Diversion /Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	10	North County Coast Water District, San Mateo County RCD, SWRCB						0	Action is considered In-Kind

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-1.1.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
TuC-CCCS-1.1.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	CDFW, IWRP, NMFS, San Mateo County RCD, Trout Unlimited, USFWS	1.50	1.50				3	Signage could also be placed along the parking lot which provides the public beach access. Cost for signage vary widely based on materials and content. Assume a minimum of 3 signs at a rate of $1,000/sign.
TuC-CCCS-1.1.1.2	Action Step	Estuary	Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.	2	10	CDFW, CDFW Law Enforcement, NMFS, Private Landowners, San Mateo County RCD						0	Action is considered In-Kind
TuC-CCCS-1.1.1.3	Action Step	Estuary	Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Tunitas Creek lagoon.	2	5	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE	3.00					3	Cost based on posting 3 signs at an estimated cost of $1,000/sign.
TuC-CCCS-1.1.2	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
TuC-CCCS-1.1.2.1	Action Step	Estuary	Develop and implement a lagoon habitat assessment program to determine the quality and function of the Tunitas Creek Lagoon/Estuary as well as seasonal steelhead use and abundance over time.	2	5	CDFW, NMFS	322.00					322	The habitat assessment should determine existing limiting factors and develop potential rehabilitation projects to address these factors. Cost based on estuary use/residence time monitoring at a rate of $321,745/project.
TuC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
TuC-CCCS-3.1.1.1	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead	2	10	CDFW, Mid Peninsula Open Space District, NMFS, San Mateo County RCD, Trout Unlimited	36.00	36.00				72	Cost for stream flow monitoring estimated at $74,376
TuC-CCCS-3.1.1.2	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFW, County of San Mateo, Mid Peninsula Open Space District, NMFS, Private Landowners, San Mateo County RCD						0	Action is considered In-Kind

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-3.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707.	2	10	CDFW, Farm Bureau, Private Landowners, San Mateo County, SWRCB						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.
TuC-CCCS-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
TuC-CCCS-5.1.1.1	Action Step	Passage	Conduct an updated fish passage assessment within the Tunitas Creek Watershed, and prioritize fish passage impediments for replacement, upgrade, or retrofit.	2	5	CDFW, County of San Mateo, Mid Peninsula Open Space District, Private Landowners, San Mateo County RCD	42.00					42	Cost based on escapement monitoring at a rate of $41,472/project.
TuC-CCCS-5.1.1.2	Action Step	Passage	Provide passage at known impediments if feasible and biologically appropriate (i.e, sufficient habitat upstream to warrant cost of enhancement).	3	5	Mid Peninsula Open Space District, Private Landowners, San Mateo County RCD, Trout Unlimited							
TuC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelters										
TuC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Mid Peninsula Open Space District, NOAA RC, Private Landowners, San Mateo County RCD	250.00					250	Cost estimate based other projects completed in the area.
TuC-CCCS-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	100	CDFW, Mid Peninsula Open Space District, NMFS, Private Landowners, San Mateo County, San Mateo County RCD						0	No cost are associated with this recommendation if habitat features are passively maintained. Action is considered In-Kind

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-6.1.1.3	Action Step	Habitat Complexity	Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	3	100	Mid Peninsula Open Space District, Private Landowners, San Mateo County, San Mateo County RCD, USFWS						0	Action is considered In-Kind
TuC-CCCS-6.2	Objective	Habitat Complexity	Address the inadequacy of existing regulatory mechanisms										
TuC-CCCS-6.2.1	Recovery Action	Habitat Complexity	Improve shelter										
TuC-CCCS-6.2.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to steelhead survival and recovery, and watershed processes.	2	10	CDFW, County of San Mateo, IWRP, Mid Peninsula Open Space District, Private Landowners, San Mateo County RCD						0	Action is considered In-Kind
TuC-CCCS-6.2.1.2	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	2	100	CDFW, County of San Mateo, NMFS, Private Consultants						0	This recommendation should be considered standard practice. Action is considered In-Kind
TuC-CCCS-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-7.1.1	Recovery Action	Riparian	Improve riparian conditions										
TuC-CCCS-7.1.1.1	Action Step	Riparian	Remove invasive exotic vegetation from riparian zones.	3	20	Mid Peninsula Open Space District, Private Landowners, San Mateo County RCD	232.50	232.50	232.50	232.50		930	Cost based on treating 0.25 miles (assume 1 project /mile in 5% high IP with 80 acres/mile) at a rate of $46,470/acre.
TuC-CCCS-7.2	Objective	Riparian	Address the inadequacy of existing regulatory mechanisms										
TuC-CCCS-7.2.1	Recovery Action	Riparian	Improve riparian conditions										
TuC-CCCS-7.2.1.1	Action Step	Riparian	Work with the County of San Mateo to revise existing tree ordinances to reduce or waive tree removal permit fees and expedite the tree removal permit process for non-native, invasive tree species (e.g., Eucalyptus and Acacia), particularly in riparian or wetland areas and on public lands when part of a habitat restoration program.	2	100	County of San Mateo, San Mateo County RCD						0	Action is considered In-Kind
TuC-CCCS-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
TuC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	CalFire, CDFW, Mid Peninsula Open Space District, NRCS, RWQCB						0	Action is considered In-Kind

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										
TuC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	5	CalFire, CDFW, Private Landowners, SWRCB						0	Require contract specifications that water trucks/tenders be fitted with CDFW and NMFS approved fish screens when drafting from fish bearing streams. Action is considered In-Kind
TuC-CCCS-15.2	Objective	Fire/Fuel Management	Address the inadequacies of existing regulatory mechanisms										
TuC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment and/or toxicity)										
TuC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire, CDFW, RWQCB, USEPA						0	Action is considered In-Kind
TuC-CCCS-15.2.1.2	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.	2	100	CalFire, CDFW, RWQCB, USEPA						0	Action is considered In-Kind
TuC-CCCS-15.2.1.3	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	10	CalFire, NMFS, RWQCB						0	Action is considered In-Kind
TuC-CCCS-15.2.1.4	Action Step	Fire/Fuel Management	Disseminate the recommendations NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	2	CalFire, NMFS, RWQCB, San Mateo County, USEPA						0	Action is considered In-Kind
TuC-CCCS-15.2.1.5	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	3	100	CalFire, NMFS, USFWS						0	Action is considered In-Kind
TuC-CCCS-21.1	Objective	Recreation	Address inadequacies of existing regulatory mechanisms										
TuC-CCCS-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to the estuary (impaired quality and extent)										
TuC-CCCS-21.1.1.1	Action Step	Recreation	Implement patrols by citizens groups and law enforcement to ensure the sandbar is not illegally breached. Increase patrols during periods of heavy beach use or when the lagoon water levels are high.	2	10	CDFW Law Enforcement, NMFS OLE						0	Action is considered In-Kind
TuC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	30	CalFire, California Geological Survey, CDFW, Mid Peninsula Open Space District, Private Landowners, RWQCB, San Mateo County, San Mateo County RCD, USACE	10.00	10.00	10.00	10.00	10.00	60	Cost based on decommissioning 2.5 miles of road at a rate of $23,940/mile.
TuC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
TuC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, County of San Mateo, RWQCB, San Mateo RCD, State Parks						0	Replacement of culverts/bridges to NMFS standards will result in increased cost for materials and construction, but will likely result in structures that can withstand large storm events better than existing structures. Long term durability and stability will result in long-term cost savings in many circumstances. This recommendation should be considered standard practice. Action is considered In-Kind
TuC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
TuC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, IWRP, Private Landowners, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
TuC-CCCS-23.1.3.2	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	10	CDFW, Mid Peninsula Open Space District, Private Landowners, RWQCB, San Mateo County, San Mateo RCD	15.00	15.00				30	A road inventory needs to be completed to determine the extent of roadside berms increasing runoff within the road network. Cost for a road inventory assessment $29,568 at a rate of $1,056/mile.
TuC-CCCS-23.1.3.3	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from steelhead streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	10	CalFire, CalTrans, CDFW, Private Landowners, San Mateo County, San Mateo RCD, State Parks						TBD	Cost cannot be determined without identifying need and location for spoils storage sites first.
TuC-CCCS-23.1.3.4	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, CDFW, NMFS, RWQCB, San Mateo County, San Mateo RCD						TBD	

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-23.1.3.5	Action Step	Roads/Railroads	Encourage County to continue implementation of the San Mateo County Road Maintenance Manual.	2	100	San Mateo County						0	Action is considered In-Kind
TuC-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
TuC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
TuC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	2	100	CalTrans, County of San Mateo, Mid Peninsula Open Space District, Private Landowners, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
TuC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, Mid Peninsula Open Space District, Private Landowners, RWQCB, San Mateo County						0	Action is considered In-Kind
TuC-CCCS-23.2.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Mid Peninsula Open Space District, Private Landowners, RWQCB, San Mateo RCD						0	Cost accounted for in remove roadside berms assuming road inventory will address winter road use.
TuC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
TuC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, Caltrans, Mid Peninsula Open Space District, Private Landowners, RWQCB, San Mateo County, San Mateo RCD						0	Action is considered In-Kind
TuC-CCCS-24.1	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
TuC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to hydrology (gravel scouring events)										
TuC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats and increase floodplain connectivity.	3	20	Mid Peninsula Open Space District, Private Landowners, San Mateo County RCD						0	Cost covered under above action (Habitat Complexity).

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-25.1	Objective	Water Diversion /Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TuC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										
TuC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Minimiize new or increased summer diversions.	2	100	CDFW, CDFW Law Enforcement, NMFS, Private Landowners, San Mateo County RCD, SWRCB						0	Action is considered In-Kind
TuC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of migration patterns for listed slamonids in the Tunitas Creek lagoon/estuary.	2	100	CDFW, CDFW Law Enforcement, Mid Peninsula Open Space District, NMFS, Private Landowners, San Mateo County RCD, SWRCB						0	Action is considered In-Kind
TuC-CCCS-25.1.2	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
TuC-CCCS-25.1.2.1	Action Step	Water Diversion /Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	10	CDFW, Mid Peninsula Open Space District, NMFS, Private Landowners, San Mateo County RCD, SWRCB						TBD	Costs cannot be estimated until an overall strategy to address diversions and their relative impact to salmonids is developed. This effort should focus on lower reaches in the watershed where the majority of problematic diversions are located.
TuC-CCCS-25.1.2.2	Action Step	Water Diversion /Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	3	100	CDFW, IWRP, Mid Peninsula Open Space District, NMFS, NRCS, SWRCB						TBD	Costs will vary depending on diversion strategy, infrastructure constraints, and landowner participation.
TuC-CCCS-25.1.2.3	Action Step	Water Diversion /Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of water quality conditions for rearing juvenile salmonids.	2	100	CDFW, County of San Mateo, Mid Peninsula Open Space District, NMFS, SWRCB						0	Action is considered In-Kind
TuC-CCCS-25.1.3	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to passage and migration										
TuC-CCCS-25.1.3.1	Action Step	Water Diversion /Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	10	CDFW, Mid Peninsula Open Space District, NMFS, Private Landowners, SWRCB						0	All authorized surface water diverters should be notified of fish screen obligations. Notification should be followed by site visits within one year by CDFW and SWRCB staff to ensure diversion are in compliance. This recommendation should be considered standard practice.
TuC-CCCS-25.2	Objective	Water Diversion /Impoundment	Address the inadequacy of existing regulatory mechanisms										

Tunitas Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TuC-CCCS-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
TuC-CCCS-25.2.1.1	Action Step	Water Diversion /Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	100	CDFW, County of San Mateo, Mid Peninsula Open Space District, NMFS, Private Landowners, RWQCB, SWRCB						0	Action is considered In-Kind
TuC-CCCS-25.2.1.2	Action Step	Water Diversion /Impoundment	Evaluate and monitor streambed alteration program compliance related to all water diversions (CDFG 2004).	2	100	CDFW, Mid Peninsula Open Space District						0	Action is considered In-Kind
TuC-CCCS-25.2.1.3	Action Step	Water Diversion /Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	3	100	CDFW, NMFS, SWRCB						0	Action is considered In-Kind

Gazos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GC-CCCS-1.1.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
GC-CCCS-1.1.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	10	IWRP, State Parks	1.50	1.50				3	Signage could also be placed along the parking lot which provides the public beach access. Cost for signage vary widely based on materials and content. Assume a minimum of 3 signs at a rate of $1,000/sign.
GC-CCCS-1.1.1.2	Action Step	Estuary	Assess the potential conflict between septic leach fields near Highway 1 and breaching of the Gazos Creek lagoon, and develop potential alternatives to address this conflict (including potential relocation of the leach fields) if warranted.	2	10	County of San Mateo, Mendocino County Department of Public Works, Private Landowners, RWQCB, San Mateo County Department of Public Health						TBD	"When the sandbar is in place the lagoon normally backs up and floods the septic tank system at the house upstream of Highway 1; this may result in repeated artificial breaching of the sandbar." (Smith 2013).
GC-CCCS-1.1.1.3	Action Step	Estuary	Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.	2	10	CDFW, County of San Mateo, Private Landowners, Public, State Parks, The Nature Conservancy, Trout Unlimited						0	Action is considered In-Kind
GC-CCCS-1.1.1.4	Action Step	Estuary	Provide financial rewards to individuals that identify persons who illegally breach the sandbar to the Gazos Creek lagoon.	2	100	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE						TBD	
GC-CCCS-1.1.2	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
GC-CCCS-1.1.2.1	Action Step	Estuary	Develop and implement a lagoon habitat assessment program to determine the quality and function of the Gazos Creek Lagoon/Estuary as well as seasonal steelhead use and abundance over time.	2	10	CDFW, State Parks	141.00	141.00				282	The habitat assessment should determine existing limiting factors and develop potential rehabilitation projects to address these factors. This may be part of the Coastal Monitoring Program in the future.
GC-CCCS-1.1.2.2	Action Step	Estuary	Expand the use of gull-proof lids on refuse cans at and around the lagoon and beach.	2	2	California Coastal Conservancy, Private Landowners, State Parks	0.20					0	Cost are estimates for a set of new garbage/recycling cans (up to 5 cans for this beach/parking lot) with gull proof lids.
GC-CCCS-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										

Gazos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-3.1.1.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	2	10	CDFW, Farm Bureau, Private Landowners, San Mateo County, SWRCB						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70,000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.
GC-CCCS-3.1.1.2	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead	3	10	CDFW, County of San Mateo, NMFS, SWRCB, USGS	37.50	37.50				75	Cost for stream flow monitoring estimated at $74,376
GC-CCCS-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve shelter rating										
GC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Conduct annual surveys in Gazos to ensure wood clusters do not create a complete barrier to adult passage.	2		CDFW, San Mateo County, State Parks						15	
GC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelter ratings										
GC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Promote and implement restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	5	CDFW, NOAA RC, Private Landowners, San Mateo RCD, State Parks, USACE	500.00					500	
GC-CCCS-6.1.2.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFW, NMFS, Private Landowners, San Mateo County, San Mateo RCD, State Parks, USACE						0	No cost are associated with this recommendation if habitat features are passively maintained.
GC-CCCS-6.1.2.3	Action Step	Habitat Complexity	Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	3	100	San Mateo County, State Parks, USFWS						0	Wood supply from upslope sources is better in Gazos Creek than many nearby watersheds in the Diversity Stratum. Action is considered In-Kind
GC-CCCS-6.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**										
GC-CCCS-6.2.1	Recovery Action	Habitat Complexity	Improve shelter rating										
GC-CCCS-6.2.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to steelhead survival and recovery, and watershed processes.	2	10	CDFW, IWRP, PG&E, Private Landowners, Public, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
GC-CCCS-6.2.1.2	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	2	100	CDFW, NMFS, Private Consultants						0	This recommendation should be considered standard practice.
GC-CCCS-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Gazos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-7.1.1	Recovery Action	Riparian	Improve riparian conditions										
GC-CCCS-7.1.1.1	Action Step	Riparian	Remove invasive exotic vegetation from riparian zones.	2	20	Private Landowners, San Mateo County RCD	82.50	82.50	82.50	82.50		330	Cost based on treating 1 mile (assume 5% of high IP) at a rate of $41,000/acre.
GC-CCCS-7.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**										
GC-CCCS-7.2.1	Recovery Action	Riparian	Improve riparian conditions										
GC-CCCS-7.2.1.1	Action Step	Riparian	Implement regulatory, abatement, and education measures to prevent the invasion of exotic species, (including exotic plants).	3	20	CalFire, California Coastal Conservancy, CDFW, County of San Mateo, Private Landowners, San Mateo County RCD, State Parks						0	Action is considered In-Kind
GC-CCCS-14.1	**Objective**	**Disease /Predation /Competition**	**Address the inadequacy of existing regulatory mechanisms**										
GC-CCCS-14.1.1	Recovery Action	Disease /Predation /Competition	Prevent or minimize reduced density, abundance, and diversity										
GC-CCCS-14.1.1.1	Action Step	Disease /Predation /Competition	Implement regulatory, abatement, and education measures to prevent the invasion of exotic species, (including exotic plants).	3	20	CalFire, California Coastal Conservancy, CDFW, Private Landowners, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
GC-CCCS-14.1.1.2	Action Step	Disease /Predation /Competition	Work with landowners in the upper watershed to discontinue practice of stocking ponds with exotic and predator fish.	3	100	CDFW, NMFS, Private Landowners, San Mateo County RCD, State Parks						0	Green sunfish and largemouth bass were present in the pond at the Mountain Camp. The pond was recently drained by vandals and exotic fish have apparently been eliminated from the pond. Future stocking of these species should not be allowed. Action is considered In-Kind
GC-CCCS-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
GC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	CalFire, CDFW, NRCS, RWQCB						0	Action is considered In-Kind
GC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										
GC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, CDFW, NMFS, Private Landowners, SWRCB						0	Require contract specifications that water trucks/tenders be fitted with CDFW and NMFS approved fish screens when drafting from fish bearing streams. Action is considered In-Kind
GC-CCCS-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of existing regulatory mechanisms**										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
GC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	3	100	CalFire, CDFW, RWQCB, USEPA						0	Action is considered In-Kind
GC-CCCS-15.2.1.2	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.	2	100	CalFire, CDFW, RWQCB, USEPA						0	Action is considered In-Kind
GC-CCCS-15.2.1.3	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	10	CalFire, NMFS, RWQCB						0	Action is considered In-Kind
GC-CCCS-15.2.1.4	Action Step	Fire/Fuel Management	Disseminate recommendations from NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	3	2	CalFire, NMFS, Private Landowners, RWQCB, San Mateo County, USACE, USEPA						0	Action is considered In-Kind
GC-CCCS-15.2.1.5	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	3	100	CalFire, NMFS, USFWS						0	Action is considered In-Kind
GC-CCCS-21.1	**Objective**	**Recreation**	**Address the inadequacies of existing regulatory mechanisms**										
GC-CCCS-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to the estuary (impaired quality and extent)										
GC-CCCS-21.1.1.1	Action Step	Recreation	Implement patrols by citizens groups and law enforcement to ensure the sandbar is not illegally breached. Increase patrols during periods of heavy beach use or when the lagoon water levels are high.	2	100	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, Private Landowners, Public						0	Action is considered In-Kind
GC-CCCS-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
GC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	30	CalFire, California Geological Survey, CDFW, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, USACE	94.17	94.17	94.17	94.17	94.17	565	Riparian roads in Gazos are the ultimate cause of many problems in the instream environment. Decommissioning high risk road segments would help to restore watershed processes. The paved County road has narrowed the floodplain upstream of Old Woman's Creek and decommissioning this road, although beneficial to watershed processes, is highly unlikely. Upgrading the road to reduce risk of episodic sediment input would be beneficial. Cost based on decommissioning 4 miles of riparian road network at a rate of $14,131/mile.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										
GC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, RWQCB, San Mateo RCD, Santa Cruz County, State Parks						0	Replacement of culverts/bridges to NMFS standards will result in increased cost for materials and construction, but will likely result in structures that can withstand large storm events better than existing structures. Long term durability and stability will result in long-term cost savings in many circumstances. This recommendation should be considered standard practice.
GC-CCCS-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
GC-CCCS-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, IWRP, Private Landowners, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
GC-CCCS-23.1.3.2	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	10	CDFW, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, State Parks	15.25	15.25				31	A road inventory needs to be completed to determine the extent of roadside berms increasing runoff within the road network. Cost for a road inventory assessment $30,543 at a rate of $1,090/mile.
GC-CCCS-23.1.3.3	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from salmonid streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	10	CalFire, CalTrans, CDFW, Private Landowners, San Mateo County, San Mateo RCD, State Parks						TBD	Cost cannot be determined without identifying need and location for spoils storage sites first.
GC-CCCS-23.1.3.4	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, CDFW, NMFS, Private Landowners, RWQCB, San Mateo RCD, State Parks	28.25	28.25				57	Initial efforts should be directed at the road system in Old Woman's Creek. The road system is located on erosive soils and is poorly located and poorly maintained. Sediment from the road system directly enters Old Woman's Creek at numerous locations. This creek is highly incised and nearly completely sandy-bed dominated. Downstream of the Gazos/Old Woman's Creek confluence, due to high rates of sediment input, steelhead spawning and rearing habitats are limited. Cost based on decommissioning 4 miles of road network at a rate of $14,131/mile.
GC-CCCS-23.1.3.5	Action Step	Roads/Railroads	Encourage San Mateo County to continue implementation of the San Mateo County Road Maintenance Manual.	2	100	San Mateo County						0	Action is considered In-Kind

Gazos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
GC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
GC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	2	100	CalTrans, County of San Mateo, Private Landowners, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
GC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, Private Landowners, RWQCB, San Mateo County						0	This recommendation should be considered standard practice.
GC-CCCS-23.2.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, NRCS, POST, Private Landowners, Public, RWQCB, State Parks						TBD	Cost accounted for in remove roadside berms assuming road inventory will address winter road use.
GC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
GC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CalTrans, RWQCB, San Mateo County, San Mateo RCD, State Parks						0	Action is considered In-Kind
GC-CCCS-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**										
GC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to hydrology (gravel scouring events)										
GC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats and increase floodplain connectivity.	3	100	Private Landowners, San Mateo County RCD, State Parks						0	Restoration projects will be developed from collaboration with stakeholders and identify feasible alternatives within the watershed. Action is considered In-Kind
GC-CCCS-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GC-CCCS-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										

Gazos Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GC-CCCS-25.1.1.1	Action Step	Water Diversion /Impoundment	Avoid new or increased summer diversions.	2	100	Private Landowners, San Mateo County, State Parks, SWRCB						0	Action is considered In-Kind
GC-CCCS-25.1.1.2	Action Step	Water Diversion /Impoundment	Review current and future water diversions (surface and groundwater) to minimize impairment of migration patters for listed salmonids in the Gazos Creek lagoon/estuary.	2	100	CDFW, Mid Peninsula Open Space District, NMFS, Private Landowners, San Mateo County RCD, State Water Resources Control Board						0	Action is considered In-Kind
GC-CCCS-25.1.2	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
GC-CCCS-25.1.2.1	Action Step	Water Diversion /Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	10	CDFW, NMFS, Private Landowners, San Mateo County, SWRCB						TBD	Costs cannot be estimated until an overall strategy to address diversions and their relative impact to salmonids is developed. This effort should focus on lower reaches in the watershed where the majority of problematic diversions are located.
GC-CCCS-25.1.2.2	Action Step	Water Diversion /Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	3	100	CDFW, IWRP, NMFS, NRCS, State Parks, SWRCB						TBD	Costs will vary depending on diversion strategy, infrastructure constraints, and landowner participation.
GC-CCCS-25.1.2.3	Action Step	Water Diversion /Impoundment	Review current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	100	CDFW, San Mateo County, State Parks, SWRCB						0	Action is considered In-Kind
GC-CCCS-25.1.3	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to passage and migration										
GC-CCCS-25.1.3.1	Action Step	Water Diversion /Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	10	CDFW, NMFS, Private Landowners, SWRCB						In-Kind.	All authorized surface water diverters should be notified of fish screen obligations. Notification should be followed by site visits within one year by CDFW and SWRCB staff to ensure diversion are in compliance. This recommendation should be considered standard practice.
GC-CCCS-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
GC-CCCS-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
GC-CCCS-25.2.1.1	Action Step	Water Diversion /Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	100	CDFW, NMFS, Private Landowners, RWQCB, San Mateo County, SWRCB						0	Action is considered In-Kind
GC-CCCS-25.2.1.2	Action Step	Water Diversion /Impoundment	Evaluate and monitor streambed alteration program compliance related to all water diversions (CDFG 2004).	2	100	CDFW						0	Action is considered In-Kind
GC-CCCS-25.2.1.3	Action Step	Water Diversion /Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	3		NMFS, San Mateo County, SWRCB						0	Action is considered In-Kind

San Vicente Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat										
SVC-CCCS-1.1.1.1	Action Step	Estuary	Maintain current stream configuration.	3	100	Caltrans, Railroad						0	The San Vicente estuary was destroyed due to construction of the railroad and highway crossings. San Vicente Creek flows out to the ocean through a bore constructed in bedrock. Re-establishing an estuary is highly impractical and is not recommended. Action is considered In-Kind
SVC-CCCS-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
SVC-CCCS-2.1.1.1	Action Step	Floodplain Connectivity	Ensure off channel habitats are adequately monitored and maintained. Develop landowner agreements.	2	10	BLM, CDFW, IWRP, Santa Cruz RCD	4.00	4.00				8	Cost are reduced due to generally cooperative landowners in the San Vicente Watershed. Most costs are likely associated with staff time. The inlet to San Vicente pond should be monitored, and problems corrected, on a weekly basis. Cost for monitoring estimated at $4,000/project with a total of two projects.
SVC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
SVC-CCCS-3.1.1.1	Action Step	Hydrology	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100	BLM, CDFW, City of Santa Cruz, County of Santa Cruz, NMFS, Santa Cruz RCD						0	Action is considered In-Kind
SVC-CCCS-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
SVC-CCCS-5.1.1.1	Action Step	Passage	Evaluate impact of Railroad and Caltrans bore to fish passage during high flow events.	2	10	BLM, Caltrans, CDFW, IWRP, NMFS, Santa Cruz County Transportation Commission, Santa Cruz RCD	164.00	164.00				328	The historical estuary has been lost due to placement of fill and rerouting the stream channel for the railroad and highway crossing. The stream now flows through a tunnel (bore) directly to the ocean. The tunnel should be monitored to ensure no blockages that could impede migration accumulate. To date, no known blockages have occurred in the recent past, but could have significant adverse impacts to a steelhead year class. Cost based on adult escapement and juvenile migration monitoring at a rate of $84,124 and $243,169/project. respectively.

San Vicente Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCCS-5.1.1.2	Action Step	Passage	Install baffles in the tunnel bore as necessary.	2	10	BLM, Caltrans, CDFW, Santa Cruz County Transportation Commission, Santa Cruz RCD	36.00	36.00				72	Cost based on $71,820/unit.
SVC-CCCS-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-6.1.1	Recovery Action	Habitat Complexity	Improve shelter										
SVC-CCCS-6.1.1.1	Action Step	Habitat Complexity	Increase shelters to optimal conditions (>80 pool shelter value) in mainstem San Vicente Creek.	2	10	BLM, IWRP, Santa Cruz County, Santa Cruz RCD	230.55	230.55				461	The most appropriate technique to increase shelter values in San Vicente Creek will likely involve installation of large woody material. Other instream habitat elements could include boulder installation and construction of features to facilitate creation of undercut stream banks. Cost based on treating 4 miles of stream at a cost of $115,276/mile.
SVC-CCCS-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency										
SVC-CCCS-6.1.2.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	BLM, CDFW, NMFS, Santa Cruz County							Costs already incorporated as part of shelter. Assuming placement of LWD will increase shelter and increase LWD frequency.
SVC-CCCS-6.1.2.2	Action Step	Habitat Complexity	Install properly sized large woody material to viability table targets throughout mainstem San Vicente Creek	1	5	BLM, IWRP, Santa Cruz RCD						TBD	Most LWD structures will need some engineering design and will need to be secured to minimize concerns due to downstream infrastructure including the Highway 1 and railroad bores. Evaluation of potential impacts to water surface elevations per FEMA concerns may also be required.
SVC-CCCS-6.1.3	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
SVC-CCCS-6.1.3.1	Action Step	Habitat Complexity	Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)).	2	10	BLM	25.00	25.00				50	The most appropriate technique to increase pool frequency in San Vicente Creek will likely involve installation of large woody material. Other instream habitat elements could include boulder installation into responsive stream reaches. Cost based on treating 2 miles of stream at a rate of $25,000/mile for LWD placement. If constructing ELJ, assume 10/mile at a rate of 115,276/ELJ for a total of 2,305,000.
SVC-CCCS-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-7.1.1	Recovery Action	Riparian	Improve riparian conditions										
SVC-CCCS-7.1.1.1	Action Step	Riparian	Remove invasive exotic vegetation from riparian zones.	2	20	BLM, IWRP, Private Landowners, Santa Cruz RCD	903	903	903	903		3,610	Initial removal efforts should be concentrated in the lower portion of the watershed which is heavily infested with ivy. Removal will likely entail a sustained effort with periodic follow-ups to ensure suppression. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $45,114/acre.

San Vicente Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCCS-7.1.1.2	Action Step	Riparian	Work with landowners to discourage planting and dumping of non-native vegetation within the riparian corridor of lower San Vicente Creek.	3	20	BLM, Private Landowners, Santa Cruz RCD						0	Action is considered In-Kind
SVC-CCCS-14.1	Objective	Disease/ Predation/ Competition	Address the inadequacy of existing regulatory mechanisms										
SVC-CCCS-14.1.1	Recovery Action	Disease/ Predation/ Competition	Prevent or minimize reduced density, abundance, and diversity										
SVC-CCCS-14.1.1.1	Action Step	Disease/ Predation/ Competition	Identify and work with landowners in the upper watershed to discontinue practice of stocking ponds with exotic and predator fish .	2	5	CDFW, IWRP, Santa Cruz County						0	Efforts should include educational outreach and regulatory oversight. Landowners should be encouraged to remove non-native fish from ponds. Non-native fish must not be placed into fish bearing streams. Action is considered In-Kind
SVC-CCCS-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SVC-CCCS-15.1.1.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	BLM, CalFire						0	Action is considered In-Kind
SVC-CCCS-15.1.1.2	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	BLM, CalFire						0	Action is considered In-Kind
SVC-CCCS-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										
SVC-CCCS-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.	2	100	BLM, CalFire						0	Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting. Action is considered In-Kind
SVC-CCCS-15.2	Objective	Fire/Fuel Management	Address the inadequacy of existing regulatory mechanisms										
SVC-CCCS-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SVC-CCCS-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC steelhead.	2	100	BLM, CalFire						0	This recommendation only applies to situations where lives and structures are not immediately threatened by wildfire. Action is considered In-Kind
SVC-CCCS-20.1	Objective	Mining	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-20.1.1	Recovery Action	Mining	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SVC-CCCS-20.1.1.1	Action Step	Mining	Tailings, settling ponds, and other attributes of mining should be secured to ensure sediment, toxins, and other deleterious substances do not enter streams through either direct runoff or subsurface flow.	2	100	CDFW, CEMEX, County of Santa Cruz, NMFS, RWQCB, USEPA						TBD	An assessment of potential site specific threats is needed in order to evaluate total costs. However, this recommendation is typically a standard business practice for mining operation due to a variety of regulatory requirements.

San Vicente Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCCS-20.1.1.2	Action Step	Mining	Abandoned mining areas in the San Vicente watershed should comply with all appropriate requirements of the Surface Mine Control and Reclamation Act.	2	100	BLM, California Geological Survey, CEMEX						TBD	This should be considered a standard business practice. A site specific evaluation is likely needed. Costs of implementing this recommendation should be borne by the quarry operator.
SVC-CCCS-22.1	Objective	Residential/ Commercial Development	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SVC-CCCS-22.1.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality and extent)										
SVC-CCCS-22.1.1.1	Action Step	Residential/ Commercial Development	Restore areas impaired by infrastructure near streams, historical floodplains or off channel habitats. Proactively work with landowners on lower San Vicente.	2	20	BLM, CDFW, IWRP, NMFS, Santa Cruz RCD	63.50	63.50	63.50	63.50		254	Working with landowners in lower San Vicente to remove problematic infrastructure could facilitate creation and enhancement of off-stream habitats beneficial to winter rearing success. Cost based on assumption of 1 project per mile in high IP habitat, total of 2 projects at a cost of $127,000/acre.
SVC-CCCS-22.2	Objective	Residential/ Commercial Development	Address the inadequacy of existing regulatory mechanisms										
SVC-CCCS-22.2.1	Recovery Action	Residential/ Commercial Development	Prevent or minimize impairment to floodplain connectivity (impaired quality and extent)										
SVC-CCCS-22.2.1.1	Action Step	Residential/ Commercial Development	Minimize future urban development in floodplains or off channel habitats	2	100	FEMA, Santa Cruz County						0	The lower portion of San Vicente provides important over wintering habitat for steelhead. Protecting these areas from future development is important for their survival and could provide future opportunities for off-channel restoration projects. Action is considered In-Kind
SVC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
SVC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	10	BLM, CalFire, County of Santa Cruz						TBD	
SVC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	10	BLM, CalFire, IWRP	56.00	56.00				112	Cost for road inventory estimated at $1,056/mile (assume 75% of road network). Cost for sediment assessment estimated at $13.90/acre (assume 25% of total watershed acres).
SVC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	20	BLM, CalFire, CalTrans, IWRP, Private Landowners, Santa Cruz RCD	8.00	8.00	8.00	8.00		32	Decommissioning approximately ten percent of the riparian roads in San Vicente Creek targets 2.3 miles of riparian road. $13,680/mile at 2.3 miles. Costs may vary depending on site conditions and other constraints.
SVC-CCCS-23.1.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	5	BLM, CalFire, California Geological Survey, Caltrans, Santa Cruz County						0	The cost estimate is low because NMFS believes relatively little grading will occur due to the small size of the watershed. Action is considered In-Kind

San Vicente Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCCS-23.1.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	BLM, CEMEX, County of Santa Cruz, Private Landowners, Santa Cruz RCD						0	These BMPs should be incorporated into all road management practices and may result in long term cost savings due to lower maintenance and repair costs. Action is considered In-Kind
SVC-CCCS-23.1.1.6	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.	2	100	BLM, CalFire, Private Landowners						0	Action is considered In-Kind
SVC-CCCS-23.1.1.7	Action Step	Roads/Railroads	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.	2	5	BLM, Santa Cruz County						0	The number of visits per year to this important watershed will likely be minimal due to the small size of the watershed. Additional costs will be necessary to meet the obligations in the ordinance in other watersheds and this expense could be spread out across the County. Action is considered In-Kind
SVC-CCCS-23.1.1.8	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	BLM, CalFire, CalTrans, CEMEX, Private Landowners, Santa Cruz County						0	Hydrologically disconnect roads in the watershed. This should be considered a standard business practice for all landowners and managers in the watershed. Action is considered In-Kind
SVC-CCCS-23.1.1.9	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	BLM, CalFire, County of Santa Cruz, PG&E						0	Action is considered In-Kind
SVC-CCCS-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										
SVC-CCCS-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	BLM, CalFire, RPFs, RWQCB, Santa Cruz County						0	All new and replacement culverts should be sized to accommodate a 100 year flow event. This recommendation applies primarily to culverts on road crossings under timber harvest in the upper portion of the watershed above anadromy.
SVC-CCCS-25.1	Objective	Water Diversion/ Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SVC-CCCS-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to watershed hydrology										
SVC-CCCS-25.1.1.1	Action Step	Water Diversion/ Impoundment	Petition the SWRCB to declare San Vicente Creek fully appropriated during summer and fall months (CDFG 2004).	2	5	BLM, CDFW, County of Santa Cruz, NMFS, Public						0	The County of Santa Cruz and the California Coastal Commission stated in their conditional use permits for CEMEX construction of a new kiln in the General Plan, that San Vicente Creek is a fully allocated watershed. With the recent closure of CEMEX less water should be diverted from the watershed. Town of Davenport water use should comply with State law. Action is considered In-Kind
SVC-CCCS-25.2	Objective	Water Diversion/ Impoundment	Address the inadequacy of existing regulatory mechanisms										
SVC-CCCS-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to watershed hydrology										

San Vicente Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCCS-25.2.1.1	Action Step	Water Diversion/ Impoundment	Develop and enforce stream flow bypass requirements for diversions on the mainstem San Vicente and Mill creeks (CDFG 2004).	2	5	BLM, CDFW, County of Santa Clara, NMFS, SWRCB	72.00					72	This cost will require transects and measurements of streamflow in the lower reaches over a multiple year period. Costs may vary depending on gauging requirements under California Fish and Game Code section 1600 stream diversion requirements *et seq.* Bypass flow requirements should assess impacts to both coho and steelhead during all life stages. Cost for stream flow model estimated at $71,825/project.
SVC-CCCS-25.2.1.2	Action Step	Water Diversion/ Impoundment	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated through conservation programs.	2	100	BLM, CDFW, CDFW Law Enforcement, NMFS, NMFS OLE, SWRCB						TBD	Consider requiring federal and state incidental take permits for water diversions if determined to adversely affect steelhead in San Vicente Creek. Cost likely accounted for in above action step.
SVC-CCCS-25.2.1.3	Action Step	Water Diversion/ Impoundment	Determine and monitor streambed alteration compliance related to water diversions (CDFG 2004).	3	1	BLM, CDFW, CDFW Law Enforcement						0	Action is considered In-Kind

Laguna Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LgnaC-CCCS-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LgnaC-CCCS-1.1.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
LgnaC-CCCS-1.1.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	5	California Coastal Conservancy, CDFW, CDFW Law Enforcement, NMFS, NMFS OLE	3.00					3	Cost based on signage costing $1,000 each with a minimum of 3.
LgnaC-CCCS-1.1.1.2	Action Step	Estuary	Provide financial rewards to individuals that identify persons who illegally breach the sandbar to the Laguna Creek lagoon.	2	100	CDFW, CDFW Law Enforcement, NMFS, NMFS OLE						TBD	Cost based on amount of incentives to establish for identifying illegal breaching.
LgnaC-CCCS-1.1.2	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
LgnaC-CCCS-1.1.2.1	Action Step	Estuary	Develop and implement a lagoon habitat assessment program to assess the quality and function of the Laguna Creek Lagoon/Estuary and continue seasonal steelhead use and abundance assessments	2		CDFW, City of Santa Cruz, NMFS, Trout Unlimited						283	The habitat assessment should determine existing limiting factors and develop potential rehabilitation projects to address these factors. Cost based on estuary use, residence time monitoring at a rate of $282,233.
LgnaC-CCCS-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LgnaC-CCCS-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
LgnaC-CCCS-3.1.1.1	Action Step	Hydrology	Promote off-channel storage and conservation measures to reduce impacts of summer and early fall water diversions (e.g. storage tanks for rural residential users).	2	50	BLM, CDFW, City of Santa Cruz, NMFS, Private Landowners, Santa Cruz RCD, SWRCB						0	Work with regulatory agencies and the public to adopt effective conservation measures to improve hydrologic function. Action is considered In-Kind
LgnaC-CCCS-3.1.1.2	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	2	50	CDFW, City of Santa Cruz, Private Landowners, Santa Cruz RCD, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-3.1.1.3	Action Step	Hydrology	Promote conjunctive use of water with water projects whenever possible to maintain or restore salmonid habitat.	3	100	BLM, CDFW, Private Landowners, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-3.2	Objective	Hydrology	Address the inadequacy of existing regulatory mechanisms										
LgnaC-CCCS-3.2.1	Recovery Action	Hydrology	Improve flow conditions										

Laguna Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LgnaC-CCCS-3.2.1.1	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	50	BLM, CDFW, City of Santa Cruz, County of Santa Cruz, NMFS, Santa Cruz County, Santa Cruz RCD, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-3.2.1.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition for change of use (California Water Code §1707).	2	100	BLM, CDFW, City of Santa Cruz, Private Landowners, Santa Cruz RCD, SWRCB						TBD	Costs will vary widely depending on quantity of water converted to instream use. Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach should occur over the entire 100 year recovery horizon.
LgnaC-CCCS-3.2.2	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
LgnaC-CCCS-3.2.2.1	Action Step	Hydrology	Implement programs so that water runoff, including surface and subsurface drainage, match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CDFW, City of Santa Cruz, County of Santa Cruz, NMFS, Private Landowners, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-3.2.2.2	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.	2	10	BLM, CDFW, County of Santa Cruz, NMFS, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-3.2.2.3	Action Step	Hydrology	Work with SWRCB and landowners to maintain or re-establish natural flow regimes for smolt migration if determined to be limiting during all water years.	3	20	BLM, CDFW, City of Santa Cruz, County of Santa Cruz, NMFS, Private Landowners, SWRCB	18.75	18.75	18.75	18.75		75	Cost based on stream flow/precipitation water balance model at a rate of $74,195/project. Costs will included evaluation of critical passage areas and modeling of potential flow solutions during April and May to ensure smolts are able to access the ocean. Likely most limiting during drought periods.
LgnaC-CCCS-3.2.2.4	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	2	100	BLM, CDFW, City of Santa Cruz, County of Santa Cruz, NMFS, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-3.2.2.5	Action Step	Hydrology	Request SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters.	2	100	BLM, CDFW, City of Santa Cruz, County of Santa Cruz, NMFS, Private Landowners, SWRCB						TBD	Cost to promote/encourage SWRCB review existing diversions (permitted and unpermitted) will likely vary between depending on the cooperation of the diverter. The SWRCB should be solicited as quickly as possible. The 100 year duration indicates that this program should continue throughout the life of the recovery plan.
LgnaC-CCCS-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LgnaC-CCCS-7.1.1	Recovery Action	Riparian	Improve riparian conditions										
LgnaC-CCCS-7.1.1.1	Action Step	Riparian	Remove invasive exotic vegetation from riparian zones.	3	50	BLM, Private Landowners, Santa Cruz RCD						TBD	Actual costs will depend on the size of the area infested with invasive exotic species (rate is $41,000 per acre).

Laguna Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LgnaC-CCCS-7.1.1.2	Action Step	Riparian	Work with landowners to discourage planting and dumping of non-native vegetation within the riparian corridor of Laguna Creek.	3	50	BLM, NRCS, Private Landowners, Santa Cruz RCD						0	Action is considered In-Kind
LgnaC-CCCS-7.1.1.3	Action Step	Riparian	Plant native riparian species in denuded areas along the lower reaches of Laguna Creek upstream of Highway 1.	3	10	BLM, Private Landowners, Santa Cruz RCD	189.00	189.00				378	Cost based on treating 0.2 miles (assume 1 project/mile in 5% high IP with 80 acres/mile) at a rate of $23,619/acre.
LgnaC-CCCS-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LgnaC-CCCS-8.1.1	Recovery Action	Sediment	Improve instream gravel quantity										
LgnaC-CCCS-8.1.1.1	Action Step	Sediment	Complete a comprehensive watershed-wide sediment source inventory and assessment for the Laguna Creek Watershed.	2	10	BLM, City of Santa Cruz, RWQCB, Santa Cruz County, Santa Cruz RCD	125.50	125.50				251	Cost based on conducting an erosion assessment for 25% of total watershed acres at a rate of $14.39/acre.
LgnaC-CCCS-8.1.1.2	Action Step	Sediment	Reduce anthropogenic sources of fine sediment loading. Where appropriate, use bioengineered practices to stabilize stream banks.	2	10	BLM, City of Santa Cruz, Private Landowners, Santa Cruz RCD						0	Action is considered In-Kind
LgnaC-CCCS-21.1	Objective	Recreation	Address the inadequacies of existing regulatory mechanisms										
LgnaC-CCCS-21.1.1	Recovery Action	Recreation	Prevent or minimize impairment to the estuary (impaired quality and extent)										
LgnaC-CCCS-21.1.1.1	Action Step	Recreation	Implement patrols by citizens groups and law enforcement to ensure the sandbar is not illegally breached. Increase patrols during periods of heavy beach use or when the lagoon water levels are high.	2	20	CDFW Law Enforcement, City of Santa Cruz, County of Santa Cruz, NMFS OLE, Private Landowners, Santa Cruz RCD						TBD	Cost for citizen patrol groups is difficult to determine due to cost of volunteers is unknown. A majority of the cost will be from agency coordination, thus, In-Kind services.
LgnaC-CCCS-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LgnaC-CCCS-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
LgnaC-CCCS-23.1.1.1	Action Step	Roads/Railroads	Use best available management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	100	BLM, CDFW, City of Santa Cruz, Santa Cruz RCD						0	Action is considered In-Kind
LgnaC-CCCS-23.1.1.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	BLM, CalFire, CDFW, City of Santa Cruz, NMFS, RWQCB, Santa Cruz County, Santa Cruz RCD						0	Cost accounted for in other actions: Sediment.

Laguna Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LgnaC-CCCS-23.1.1.3	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	10	BLM, CDFW, City of Santa Cruz, Private Landowners, RWQCB, Santa Cruz County, Santa Cruz RCD						TBD	A road inventory needs to be completed to determine the extent of roadside berms increasing runoff within the road network. Cost rate for a road inventory assessment are approximately $1,090/mile.
LgnaC-CCCS-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
LgnaC-CCCS-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)										
LgnaC-CCCS-23.2.1.1	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	, BLM, Caltrans, Private Landowners, Santa Cruz County, Santa Cruz RCD						0	Action is considered In-Kind
LgnaC-CCCS-23.2.1.2	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	BLM, CalFire, City of Santa Cruz, RWQCB, Santa Cruz County, Santa Cruz RCD						TBD	Cost accounted for in above action step. Cost to treat chronic sediment sources likely be part of ongoing maintenance and upgrades.
LgnaC-CCCS-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
LgnaC-CCCS-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	BLM, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD						0	Action is considered In-Kind
LgnaC-CCCS-24.1	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										
LgnaC-CCCS-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to hydrology (gravel scouring events)										
LgnaC-CCCS-24.1.1.1	Action Step	Severe Weather Patterns	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats and increase floodplain connectivity.	3	20	BLM, CDFW, NMFS, Private Landowners, Santa Cruz RCD, State Parks						0	Action is considered In-Kind
LgnaC-CCCS-25.1	Objective	Water Diversion/Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
LgnaC-CCCS-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to the estuary (impaired quality and extent)										
LgnaC-CCCS-25.1.1.1	Action Step	Water Diversion/Impoundment	Minimize new or increased summer diversions.	2	100	BLM, Private Landowners, Santa Cruz RCD, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-25.1.1.2	Action Step	Water Diversion/Impoundment	Review current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in the Laguna Creek lagoon/estuary.	2	100	BLM, CDFW, NMFS, Santa Cruz RCD, SWRCB						0	Action is considered In-Kind

Laguna Creek, Central California Coast Steelhead (Santa Cruz Mountains) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K)						Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LgnaC-CCCS-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
LgnaC-CCCS-25.1.2.1	Action Step	Water Diversion/Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	10	BLM, CDFW, City of Santa Cruz, NMFS, Private Landowners, Santa Cruz County, Santa Cruz RCD, SWRCB						TBD	Costs cannot be estimated until an overall strategy to address diversions and their relative impact to salmonids is developed. This effort should focus on lower reaches in the watershed where the majority of problematic diversions are located.
LgnaC-CCCS-25.1.2.2	Action Step	Water Diversion/Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	3	100	BLM, CDFW, City of Santa Cruz, IWRP, NMFS, NRCS, Santa Cruz County, Santa Cruz RCD, SWRCB						TBD	Costs will vary depending on diversion strategy, infrastructure constraints, and landowner participation.
LgnaC-CCCS-25.1.2.3	Action Step	Water Diversion/Impoundment	Review current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	100	BLM, CDFW, City of Santa Cruz, NMFS, Santa Cruz County, Santa Cruz RCD, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to passage and migration										
LgnaC-CCCS-25.1.3.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	10	BLM, CDFW, City of Santa Cruz, NMFS, Private Landowners, Santa Cruz County, SWRCB						In-Kind.	All authorized surface water diverters should be notified of fish screen obligations. Notification should be followed by site visits within one year by CDFW and SWRCB staff to ensure diversion are in compliance. This recommendation should be considered standard practice.
LgnaC-CCCS-25.2	Objective	Water Diversion/Impoundment	Address the inadequacy of existing regulatory mechanisms.										
LgnaC-CCCS-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
LgnaC-CCCS-25.2.1.1	Action Step	Water Diversion/Impoundment	Ensure all water diversions and impoundments are compliant with AB2121 or other appropriate protective measures.	2	100	BLM, CDFW, NMFS, Private Landowners, SWRCB						0	Action is considered In-Kind
LgnaC-CCCS-25.2.1.2	Action Step	Water Diversion/Impoundment	Evaluate and monitor streambed alteration rogram compliance related to all water diversions (CDFG 2004).	2	100	BLM, CDFW						0	Action is considered In-Kind
LgnaC-CCCS-25.2.1.3	Action Step	Water Diversion/Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	3	10	BLM, NMFS, SWRCB						0	Action is considered In-Kind