

San Lorenzo River



Location	• Santa Cruz County
Watershed Area	• 139.0 Square Miles
Potential Habitat	• 117.5 Stream Miles
Vegetation	• 62% Coniferous forest, 22% Grassland or Shrubland, 16% Urban
Erodability	• Moderate to High
Ownership Patterns	• 90% Private; 10% Public
Dominant Land Uses	• Rural Residential, Timber, Agricultural
Housing Density	• High
TMDL Pollutants	• Nutrients, Pesticides, Pathogens, PCBs, Sediment



San Lorenzo River
Photo © USGS

San Lorenzo River Coho Salmon: Nearly Extirpated



Recovery Goals

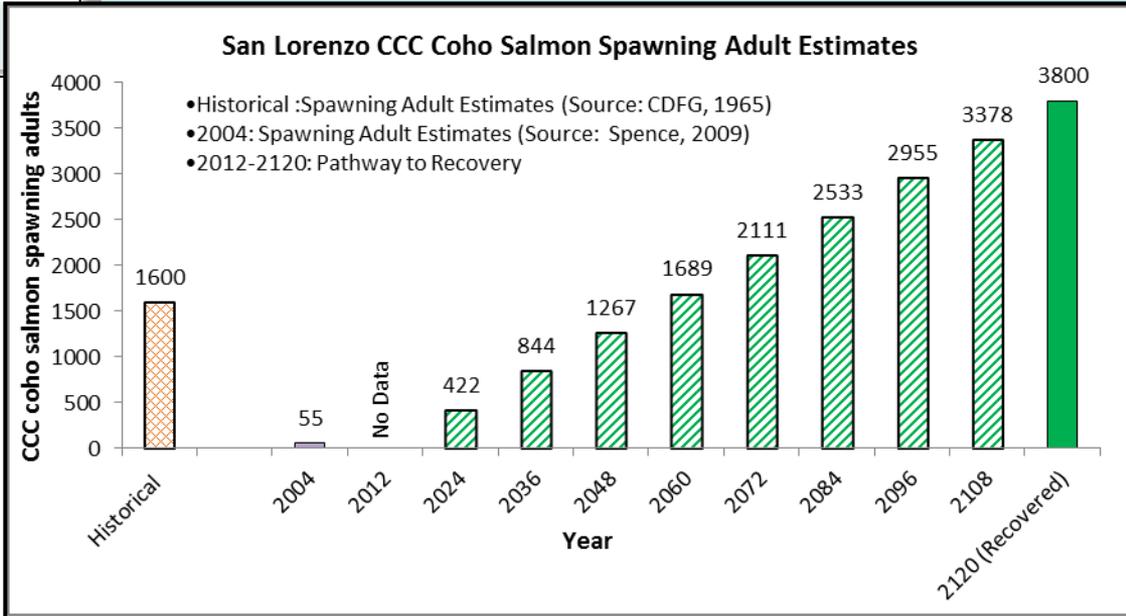
- ✓ Implement a monitoring program to evaluate presence and the performance of recovery efforts
- ✓ Continue ongoing monitoring of juveniles

**San Lorenzo River
Adult Spawner Targets**

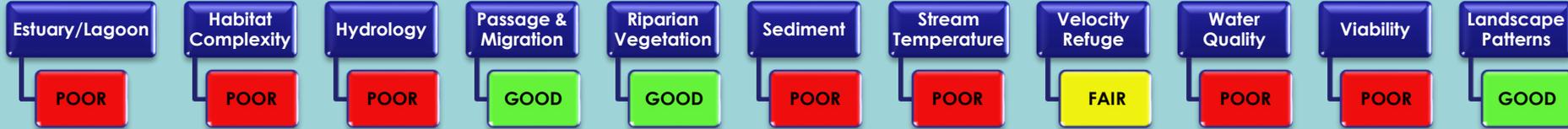
**Downlisting to Threatened
1,900**

**Recovery
3,800**

STEELHEAD: YES
CHINOOK SALMON: NO



Current Instream, Watershed and Population Conditions



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Regulate streamside wells and groundwater
- Re-introduce coho salmon into areas when habitat becomes suitable
- Retain, recruit and actively input large wood into stream
- Restore and protect summer flows
- Hydrologically disconnect and winterize roads

Priority 2 & 3: Long-Term Restoration Actions

- Post interpretive signs to discourage breaching of the lagoon
- Promote off channel storage
- Reduce sediment input
- Develop a plan for water storage and conservation



Recovery Partners

RWQCB



Future Threats



Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Ensure all diversions are properly permitted
- Set back future development from streams and floodplains
- Locate new roads away from wetlands and floodplains
- Ensure new construction occurs outside flood prone areas
- Enhance retention and recruitment of LWD

Priority 2 & 3: Long-Term Threat Abatement Actions

- Monitor the river mouth until natural breaching occurs
- Increase stream buffers and improve roads for timber harvest
- Monitor passage at summer dams
- Encourage the use of native plants in landscaping
- Eliminate use of gabion baskets and undersized rock in channels
- Conduct education and outreach



Passage impediment on San Lorenzo River
Photo by D.W. ALLEY & Associates

Conservation Highlights

- The San Lorenzo Valley Water Agency and the County of Santa Cruz are funding annual juvenile abundance surveys
- The Santa Cruz RCD and the California Coastal Conservancy are involved in numerous barrier removal/modification and sediment remediation projects
- The City of Santa Cruz is developing a HCP

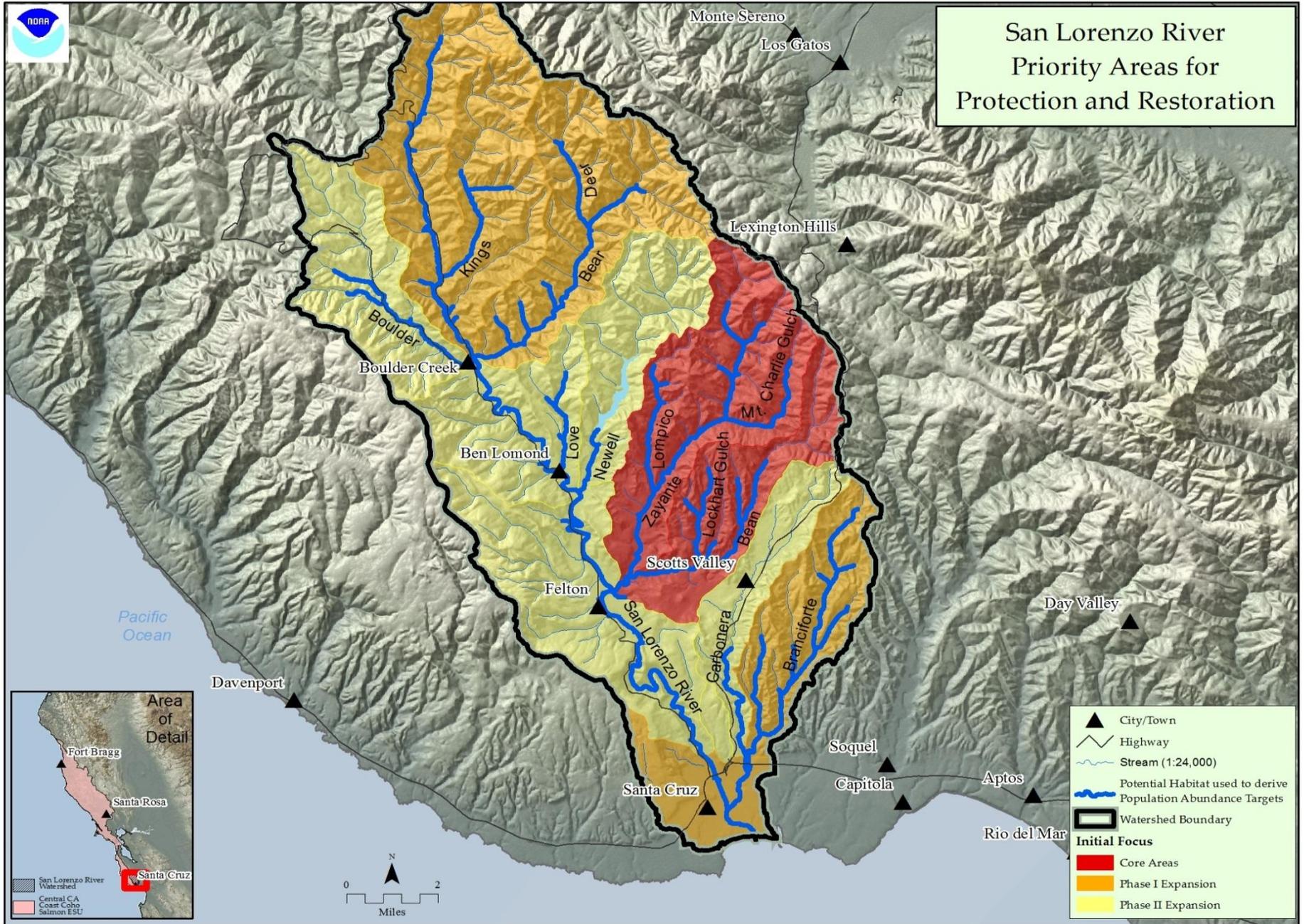


Figure 1: Map of San Lorenzo River
San Lorenzo River

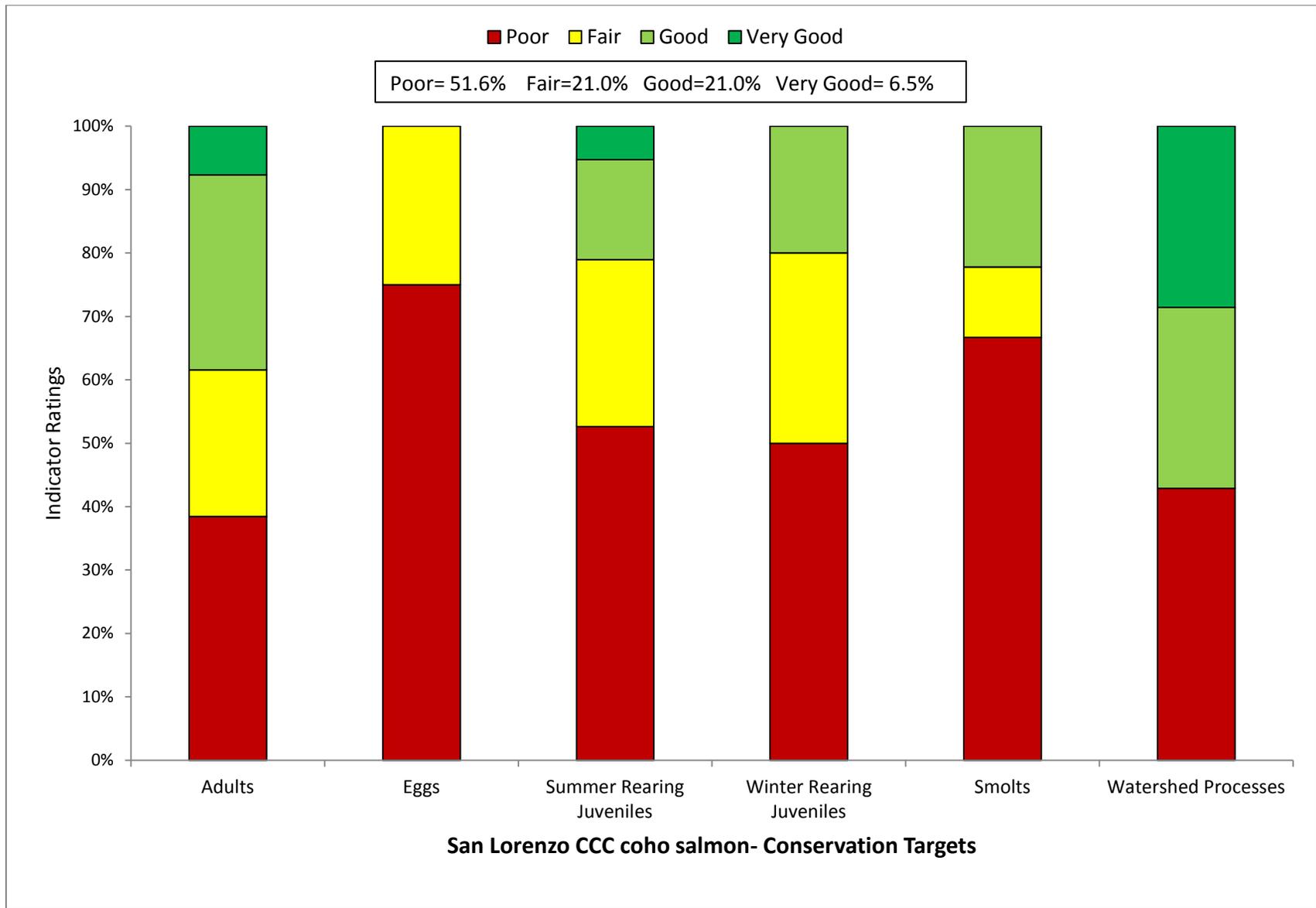


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ San Lorenzo River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<4 Key Pieces/100m	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<1 Key Pieces/100m	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	36% streams 52% IP-km (>30% Pools; >20% Riffles)	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	7% streams 2% IP-km (>80 stream average)	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	Risk Factor Score = 42	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	75% of IP-km to 90% of IP-km accessible	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	83% of IP-km accessible	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	NA	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	≥80% Density rating "D" across IP-km	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	>90% of IP-km accessible	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	50-80% Response Reach Connectivity	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	Sublethal or Chronic	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	<1 spawner per IP-km	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score = 58	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	Risk Factor Score = 83	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	14% streams 5% IP-km (>50% stream average scores of 1 & 2)	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	Impaired and not functioning	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<4 Key Pieces/100m	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 Key Pieces/100m	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	36% streams 68% IP-km (>49% of pools are primary pools)	Fair	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	36% streams 52% IP-km (>30% Pools; >20% Riffles)	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	7% streams 2% IP-km (>80 stream average)	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	Risk Factor Score >75	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score = 51-75	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	6.8 Diversions/10 IP-km	Poor	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	75% of IP-km to 90% of IP-km accessible	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	83% of IP-km accessible	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	93% of streams/IP-km with average canopy >85%	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	NA	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	≥80% Density rating "D" across IP-km	Good	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	14% streams 5% IP-km (>50% stream average scores of 1 & 2)	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	<50% IP-km (<16 C MWMT)	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	Sublethal or Chronic	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	<0.2 fish/meter ²	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter ²
Summer Rearing Juveniles	Viability	Spatial Structure	<50% of Historical Range	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<4 Key Pieces/100m	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 Key Pieces/100m	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	36% streams 52% IP-km (>30% Pools; >20% Riffles)	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	7% streams 2% IP-km (>80 stream average)	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	83% of IP-km accessible	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	NA	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	≥80% Density rating "D" across IP-km	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	14% streams 5% IP-km (>50% stream average scores of 1 & 2)	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	50-80% Response Reach Connectivity	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	Sublethal or Chronic	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	Impaired and not functioning	Poor	SEC Analysis/CDFG Data	Property Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	7% streams 2% IP-km (>80 stream average)	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	6.8 Diversions/10 IP-km	Poor	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	Risk Factor Score >75	Poor	TRT Spence (2008)	NMFS Flow Protocol Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	75% of IP-km to 90% of IP-km accessible	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	75-90% IP-km (>6 and <16 C)	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	Sublethal or Chronic	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	Abundance leading to high risk spawner density = 0	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	5.69% of Watershed in Impervious Surfaces	Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	0.25% of Watershed in Agriculture	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	6% of Watershed in Timber Harvest (in last 13 years)	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	>74% of watershed >1 unit/20 acres	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	51 -74%> Historical Species Composition	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	5.3 Miles/Square Mile	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	6.2 Miles/Square Mile	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ San Lorenzo River

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

Central CA Coast Coho ~ San Lorenzo River

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

- 1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range
 - 1.1.1. **Recovery Action:** Increase the extent of estuarine habitat
 - 1.1.1.1. **Action Step:** Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).
 - 1.1.1.2. **Action Step:** Remove structures impairing or reducing the historical feeding and salt water transition habitat where feasible and benefits to coho salmon and/or the estuarine environment are predicted.
 - 1.1.1.3. **Action Step:** Remove 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 from modification and/or reduction in the size of the San Lorenzo Park in the City of Santa Cruz.
 - 1.1.2. **Recovery Action:** Reduce frequency of artificial breaching events
 - 1.1.2.1. **Action Step:** Seek State legislation to address liability issues regarding lagoon management.
 - 1.1.2.2. **Action Step:** Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the SLR lagoon.
 - 1.1.2.3. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.
 - 1.1.2.4. **Action Step:** Install educational signage along key areas of the estuary to educate the public regarding the importance of estuaries and lagoons for fish and wildlife.
 - 1.1.3. **Recovery Action:** Improve the quality of each estuarine habitat zone
 - 1.1.3.1. **Action Step:** Enhance streambed aquatic cover and substrate in estuarine and transitional reaches of the SLR.
 - 1.1.3.2. **Action Step:** Enhance riverbank shoreline habitat in transitional and estuarine reaches.
 - 1.1.3.3. **Action Step:** Install structures designed to enhance scour, increase residual pool depth and shelter for smolt transition and feeding during the spring.
 - 1.1.4. **Recovery Action:** Increase the rate of lagoon formation and/or freshwater conversion
 - 1.1.4.1. **Action Step:** Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.
 - 1.1.5. **Recovery Action:** Reduce toxicity and pollutants

- 1.1.5.1. **Action Step:** Continue implementation of sanitary sewer upgrades, sewer maintenance and storm drain maintenance practices.
 - 1.1.5.2. **Action Step:** 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.
 - 1.1.5.3. **Action Step:** 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.
 - 1.1.5.4. **Action Step:** Develop and implement a strategy to eliminate likely water quality impacts from camping and loitering in floodplain areas.
 - 1.1.5.5. **Action Step:** Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.
 - 1.1.5.6. **Action Step:** Consider requiring evaluation and repair of private sewer laterals, particularly in areas prone to high groundwater conditions.
 - 1.1.5.7. **Action Step:** Implement dry weather diversion of storm drain discharge to the sanitary sewer system where other control measures are unsuccessful at reducing bacteria levels.
 - 1.1.5.8. **Action Step:** Regularly clean storm drains and removal of accumulations of silt and organic material, particularly before the first storm of the season.
 - 1.1.5.9. **Action Step:** 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.
- 1.1.6. **Recovery Action:** Increase freshwater lagoon elevation during seasonal closures
- 1.1.6.1. **Action Step:** Evaluate and implement possible structural improvements to maintain water surface elevations during the summer through the late fall in the lagoon.

2. Restoration- Floodplain Connectivity

No species-specific actions were developed.

3. Restoration- Habitat Complexity

- 3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range
 - 3.1.1. **Recovery Action:** Increase large wood frequency
 - 3.1.1.1. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.
 - 3.1.1.2. **Action Step:** Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

- 3.1.1.3. **Action Step:** 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.
- 3.1.1.4. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.
- 3.1.1.5. **Action Step:** Encourage the County of Santa Cruz to expand large instream wood structure tracking.
- 3.1.1.6. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.
- 3.1.2. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.
 - 3.1.2.1. **Action Step:** Target restoration actions in the mainstem reach between the upper Rincon Bend and the Tait Street diversion.
- 3.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence
 - 3.2.1. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.
 - 3.2.1.1. **Action Step:** Fund a watershed coordinator position.

4. [Restoration- Hydrology](#)

- 4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range
 - 4.1.1. **Recovery Action:** Improve flow conditions
 - 4.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).
 - 4.1.1.2. **Action Step:** Promote conjunctive use of water for water projects whenever possible to maintain or restore coho salmon habitat.
 - 4.1.1.3. **Action Step:** 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.
 - 4.1.1.4. **Action Step:** Investigate the potential for expansion of the Scott Valley water reclamation system.
 - 4.1.1.5. **Action Step:** Investigate water recharge possibilities in Scotts Valley quarries.
 - 4.1.1.6. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.
 - 4.1.1.7. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).
 - 4.1.1.8. **Action Step:** Adopt policies and practices for redevelopment/reconstruction projects to reduce storm water runoff.

4.1.1.9. **Action Step:** 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.

4.1.1.10. **Action Step:** Promote irrigation efficiency projects for agricultural practices.

4.1.2. **Recovery Action:** Minimize redd scour

4.1.2.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

4.1.3. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.3.1. **Action Step:** 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.

4.1.3.2. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

4.1.3.3. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

5.1.1.1. **Action Step:** 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

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Improve access of spawning adults and juveniles

6.1.1.1. **Action Step:** Remediate passage barriers on mainstem San Lorenzo River.

6.1.1.2. **Action Step:** Remediate passage barriers in San Lorenzo River tributaries.

7. Restoration- Pool Habitat

No species-specific actions were developed.

8. Restoration- Riparian

8.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

8.1.1. **Recovery Action:** Protect existing riparian areas

8.1.1.1. **Action Step:** Work with PG&E to ensure practices do not impair riparian areas.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

- 9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment
 - 9.1.1.1. **Action Step:** Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.
 - 9.1.1.2. **Action Step:** Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Lorenzo River.
- 9.1.2. **Recovery Action:** Improve instream gravel quality
 - 9.1.2.1. **Action Step:** Conduct road surveys beginning with inner gorge roads in sandy soils followed by roads in other settings.
 - 9.1.2.2. **Action Step:** Implement sediment reduction efforts on tributaries that deliver sediment directly to the Middle River and on Zayante and Branciforte Creeks.

10. Restoration- Viability

- 10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.
 - 10.1.1. **Recovery Action:** Increase abundance
 - 10.1.1.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat determined appropriate by NMFS and CDFG.
 - 10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.
- 10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
 - 10.2.1. **Recovery Action:** Increase spatial structure and diversity
 - 10.2.1.1. **Action Step:** Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.
 - 10.2.2. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.
 - 10.2.2.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.
 - 10.2.2.2. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.
 - 10.2.3. **Recovery Action:** Increase spawner density
 - 10.2.3.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.2.3.2. **Action Step:** Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery.

10.3. **Objective:** Address other natural or manmade factors affecting the species' continued existence

10.3.1. **Recovery Action:** Increase spawner density

10.3.1.1. **Action Step:** Supplement existing populations where appropriate, while minimizing departure from the populations historical genetic profile. Evaluate feasibility and benefits of constructing and operating a conservation hatchery for the propagation of CCC coho salmon. Construct and operate the facility is determined to be feasible and beneficial.

10.3.1.2. **Action Step:** Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve instream temperature conditions

11.1.1.1. **Action Step:** Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.

11.1.2. **Recovery Action:** Reduce toxicity and pollutants.

11.1.2.1. **Action Step:** Implement improved wastewater disposal management through the San Lorenzo Wastewater Management Plan.

11.1.2.2. **Action Step:** Work with stable owners to reduce nitrate discharge by at least 50%

11.1.2.3. **Action Step:** Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** 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.

11.1.3.2. **Action Step:** 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.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

- 13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
 - 13.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
 - 13.1.1.1. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.
 - 13.1.1.2. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.
 - 13.1.1.3. **Action Step:** 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.
 - 13.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity
 - 13.1.2.1. **Action Step:** 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.
 - 13.1.2.2. **Action Step:** 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.
- 13.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
 - 13.2.1. **Recovery Action:** Prevent impairment to habitat complexity
 - 13.2.1.1. **Action Step:** Encourage the Corps of Engineers to review and modify maintenance requirements on the lower San Lorenzo River in the light of designated Critical Habitat obligations.
 - 13.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)
 - 13.2.2.1. **Action Step:** Modify county regulatory and planning processes to eliminate provisions allowing reconstruction, expansion, or (in some situations) channel stabilization within the 100-year flood prone zones.

14. Threat- Disease/Predation/Competition

- 14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.
 - 14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure
 - 14.1.1.1. **Action Step:** Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.

14.1.1.2. **Action Step:** Prevent spread of the New Zealand mudsnail from the San Lorenzo River to other adjacent watersheds.

14.2. **Objective:** Address disease or predation

14.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.2.1.1. **Action Step:** Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.

14.2.1.2. **Action Step:** Evaluate possible impacts of annual planting of Chinook salmon from Central Valley hatcheries into Monterey Bay to coho salmon survival and abundance.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.5. **Action Step:** Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the San Lorenzo River watershed (and all other watersheds in the County).

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** 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.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy or existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

- 16.1.1.1. **Action Step:** Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.
- 16.1.1.2. **Action Step:** Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.
- 16.1.1.3. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for the San Lorenzo River.
- 16.1.1.4. **Action Step:** 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.).
- 16.1.1.5. **Action Step:** Increase oversight on anglers fishing in the San Lorenzo River Gorge to ensure compliance with fishing regulations.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to habitat complexity

19.1.2.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

19.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.3.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.3.2. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.3.3. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.4.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.4.2. **Action Step:** Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.

19.1.5. **Recovery Action:** Prevent increased landscape disturbance

19.1.5.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc).

19.1.6. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, etc.)

19.1.6.1. **Action Step:** 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.

19.1.6.2. **Action Step:** Avoid road construction in riparian zones

19.1.6.3. **Action Step:** 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.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

19.2.1.1. **Action Step:** Increase buffer widths on Class II streams.

19.2.2. **Recovery Action:** Prevent increased landscape disturbance

19.2.2.1. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.

19.2.2.2. **Action Step:** 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 coho salmon

19.2.2.3. **Action Step:** Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).

19.2.2.4. **Action Step:** Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.

19.2.2.5. **Action Step:** Erosion control measures and road maintenance should be maintained during the entire period between re-entries.

19.2.2.6. **Action Step:** Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.

20. [Threat- Mining](#)

No species-specific actions were developed.

21. Threat- Recreation

21.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

21.1.1. **Recovery Action:** Prevent impairment to passage and migration

21.1.1.1. **Action Step:** Remove all existing summer dams that create a passage impediment to migrating adults or juveniles.

21.1.1.2. **Action Step:** Require monitoring of adult/juvenile passage at summer dam passage facilities.

21.1.1.3. **Action Step:** Implement the most recent NMFS' Guidelines for Summer Dams for all new summer dams seeking 1600 Agreement or Corps 404 permit.

21.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

21.1.2.1. **Action Step:** 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.

21.1.2.2. **Action Step:** Educate users (including mountain bikers, hikers, ORV users, etc) to help prevent or control erosion and sediment problems along the stream.

21.1.2.3. **Action Step:** Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

21.2. **Objective:** Address inadequacies of regulatory mechanisms

21.2.1. **Recovery Action:** Prevent impairment to water quality

21.2.1.1. **Action Step:** Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.1.1. **Action Step:** New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.

22.1.1.2. **Action Step:** 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.

22.1.1.3. **Action Step:** Provide incentives for water storage and water retention programs and other conservation devices

- 22.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
 - 22.1.2.1. **Action Step:** Encourage Santa Cruz County to assess the effectiveness of Sensitive Habitat Ordinance and implement improved performance measures as necessary.
 - 22.1.2.2. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.
 - 22.1.2.3. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.
 - 22.1.2.4. **Action Step:** 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.
- 22.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)
 - 22.1.3.1. **Action Step:** Design new development to allow streams to meander in historical patterns.
 - 22.1.3.2. **Action Step:** 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 through a buyout program.
 - 22.1.3.3. **Action Step:** Evaluate watershed infrastructure at high risk of flooding.
 - 22.1.3.4. **Action Step:** Encourage establishment of conservation easements on floodplain habitat in key stream reaches.
- 22.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure
 - 22.1.4.1. **Action Step:** Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.
- 22.1.5. **Recovery Action:** Prevent increased landscape disturbance
 - 22.1.5.1. **Action Step:** Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.
 - 22.1.5.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.
- 22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
 - 22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure
 - 22.2.1.1. **Action Step:** Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.
 - 22.2.2. **Recovery Action:** Prevent impairment to water quality

- 22.2.2.1. **Action Step:** Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.
- 22.2.2.2. **Action Step:** Continue efforts to address failing septic systems in rural areas and other water quality impairments
- 22.2.2.3. **Action Step:** Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo River Watershed.
- 22.2.2.4. **Action Step:** Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.

22.2.3. **Recovery Action:** Prevent impairment to watershed hydrology

- 22.2.3.1. **Action Step:** 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.
- 22.2.3.2. **Action Step:** 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.
- 22.2.3.3. **Action Step:** Support the development and implementation of regulations for activities that adversely impact groundwater recharge.

22.2.4. **Recovery Action:** Prevent increased landscape disturbance

- 22.2.4.1. **Action Step:** 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.
- 22.2.4.2. **Action Step:** Discourage Counties from rezoning forestlands to rural residential.
- 22.2.4.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.2.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

- 22.2.5.1. **Action Step:** 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.
- 22.2.5.2. **Action Step:** Minimize redevelopment within the 100 year floodplain.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

- 23.1.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.2.2. **Action Step:** 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.

23.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.3.1. **Action Step:** 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).

23.1.3.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.3.3. **Action Step:** Reduce erosion from mainline timber harvest roads.

23.1.3.4. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.3.5. **Action Step:** Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.

23.1.3.6. **Action Step:** 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.

23.1.3.7. **Action Step:** 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.

23.1.3.8. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.3.9. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.3.10. **Action Step:** Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.

23.1.3.11. **Action Step:** 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.

23.1.3.12. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.

23.1.3.13. **Action Step:** 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.

23.1.3.14. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.4. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.4.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.1.5. **Recovery Action:** Prevent impairment to passage and migration

23.1.5.1. **Action Step:** Target low flow crossings in Branciforte Creek for removal.

23.1.5.2. **Action Step:** 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.

23.1.5.3. **Action Step:** 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.

23.1.6. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.6.1. **Action Step:** Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.1.6.2. **Action Step:** 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.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.

23.2.1.2. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

23.2.2. **Recovery Action:** Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.

23.2.2.1. **Action Step:** Educate road associations and informal road maintenance collectives to the benefit of integrating into the Santa Cruz County Service Area process.

23.2.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.3.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.3.2. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.

23.2.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.4.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.4.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.2.4.3. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

23.2.4.4. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

24.1.1.1. **Action Step:** 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).

24.1.1.2. **Action Step:** 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).

24.1.1.3. **Action Step:** 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.

24.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

- 24.1.2.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions.
- 24.1.2.2. **Action Step:** Ensure all water diversions in the watershed are in compliance with all applicable laws and policies during dry and critically dry water years.
- 24.1.2.3. **Action Step:** 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.
- 24.1.2.4. **Action Step:** Prohibit filling of all recreational instream summer dams during drought periods.
- 24.1.3. **Recovery Action:** Implement performance standards in Stormwater Management Plans.
 - 24.1.3.1. **Action Step:** Ensure tolerable water temperatures are maintained during drought periods.
- 24.1.4. **Recovery Action:** Prevent impairment to passage and migration
 - 24.1.4.1. **Action Step:** Manage Loch Lomond reservoir to maintain suitable rearing conditions in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).
 - 24.1.4.2. **Action Step:** 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.
 - 24.1.4.3. **Action Step:** Work with CDFG, 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 coho lifestages.
 - 24.1.4.4. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.
 - 24.1.4.5. **Action Step:** CDFG, 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 coho salmon.
 - 24.1.4.6. **Action Step:** Evaluate performance of all existing fish ladders on the San Lorenzo River to pass migrating fish during drought and high flow conditions.
- 24.1.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)
 - 24.1.5.1. **Action Step:** Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.
 - 24.1.5.2. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.
 - 24.1.5.3. **Action Step:** Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.

24.1.6. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.6.1. **Action Step:** Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in Santa Cruz County.

24.1.6.2. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

24.1.6.3. **Action Step:** Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.6.4. **Action Step:** Continue implementation of the County of Santa Cruz's Grading and Erosion Control Ordinances.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater, legal and illegal) do not further impair estuary water quality conditions for rearing juvenile salmonids.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).

25.1.2.3. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.2.4. **Action Step:** Investigate feasibility of desalination to prevent stream dewatering and ensure a more stable source of water overtime.

25.1.2.5. **Action Step:** 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 Section 1707.

25.1.2.6. **Action Step:** Investigate the potential for expansion of the Scott Valley water reclamation system.

25.1.2.7. **Action Step:** Investigate water recharge possibilities in Scotts Valley quarries as a water conservation strategy.

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in the San Lorenzo River.

25.1.3.2. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.4.1. **Action Step:** Ensure water diversions do not impair water temperatures in the San Lorenzo River.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** 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).

25.2.1.2. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.3. **Action Step:** Petition the SWRCB to declare the Santa Margarita aquifer fully appropriated.

25.2.1.4. **Action Step:** 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.

25.2.1.5. **Action Step:** 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.

25.2.1.6. **Action Step:** Prohibit new or increased summer diversions.

25.2.1.7. **Action Step:** Work with the City of Santa Cruz (and other major diverters) to minimize impacts of their diversions.

25.2.1.8. **Action Step:** 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.

25.2.1.9. **Action Step:** Encourage Lompico Water District to come into compliance with CDFG streambed alteration requirements.

25.2.1.10. **Action Step:** Identify source of dewatering in Carbonera Creek near the City of Scotts Valley.

26. [Threat- Watershed Process](#)

No species-specific actions were developed.

Table 3: Implementation Schedule ~ San Lorenzo River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-1.1	Objective	Estuary	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
SLR-CCC-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, CDFG, City of Santa Cruz, Santa Cruz RCD	518	518	518	518	518	3,110	Lower priority for coho salmon than steelhead but will benefit smolt transition and adult upmigration. 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.
													Costs of implementation will likely be significant. A new parking area may need to be constructed. This action will result in direct benefits for year-round rearing for federally listed CCC steelhead and tidewater goby, smolt transition for CCC coho salmon and benefit overall water quality in the lagoon. Benefits to CCC coho will be directed at smolt outmigration in preparation for ocean entry. Benefits are anticipated to be achieved by increasing the size of the historical tidal prism which will increase the total quantity of available rearing habitat. Recommendation and cost estimate developed from the Lower San Lorenzo Urban River Plan (City of Santa Cruz 2003). Evaluate benefits to lagoon tidal prism from modification and/or reduction in the size of Santa Cruz Boardwalk Amusement Park's parking lot. Costs will be significant because the parking lot is protected by a levee which would also need to be deconstructed and relocated in order to provide protection for other adjacent residences and businesses. New levees would need be

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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 coho salmon and/or the estuarine environment are predicted.	3	30	CA Coastal Commission, CDFG, City of Santa Cruz, Private Landowners, USACE, USFWS						TBD	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, particularly if actions are focused on enhancing the estuarine reach as defined in the Lower San Lorenzo River & Lagoon Management Plan (Swanson Hydrology & Geomorphology et al., 2002). Partial cost accounted for in restore estuarine habitat. Cost to acquire park cannot be determined and will be based on current market value. Partial cost accounted for in estuarine habitat. Cost of acquiring the parking cannot be determined.
SLR-CCC-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
SLR-CCC-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).
SLR-CCC-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	CDFG 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.
SLR-CCC-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	CDFG, 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-CCC-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	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.
SLR-CCC-1.1.3	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-1.1.3.1	Action Step	Estuary	Enhance streambed aquatic cover and substrate in estuarine and transitional reaches of the SLR.	3	15	CDFG, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, USACE	207.00	207.00	207.00			621	Recommendation from the Lower San Lorenzo River and Lagoon Management Plan (Stillwater Sciences 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 \$310,216/acre.
SLR-CCC-1.1.3.2	Action Step	Estuary	Enhance riverbank shoreline habitat in transitional and estuarine reaches.	2	10	CDFG, City of Santa Cruz, Santa Cruz RCD, USACE							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-CCC-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	CDFG, 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 likely accounted for in above action steps.
SLR-CCC-1.1.4	Recovery Action	Estuary	Increase the rate of lagoon formation and/or freshwater conversion										
SLR-CCC-1.1.4.1	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	CDFG, City of Santa Cruz, NMFS, SWRCB						In-Kind	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.
SLR-CCC-1.1.5	Recovery Action	Estuary	Reduce toxicity and pollutants										
SLR-CCC-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						In-Kind	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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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.
SLR-CCC-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-CCC-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						In-Kind	This is a complicated effort that will need to involve community leaders, law enforcement, and homeless services providers.
SLR-CCC-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							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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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.
SLR-CCC-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							Control of sewer leaks and other sources of bacterial 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.
SLR-CCC-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-CCC-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						In-Kind	This recommendation originated from the San Lorenzo Urban River Plan (City of Santa Cruz 2003).
SLR-CCC-1.1.6	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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-CCC-3.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
SLR-CCC-3.1.1.1	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	CDFG, City of Santa Cruz, IWRP, NOAA RC, NRCS, Santa Cruz County, Santa Cruz RCD						In-Kind	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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-3.1.1.2	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	10	CalFire, CalTrans, CDFG, IWRP, NRCS, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, State Parks, USACE	315.00	315.00				630	Data on LWD quantity are lacking 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 \$28,500/mile. SLR has 136 miles of IP habitat but it is assumed that many reaches will not be treated due to (often erroneous) 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 \$2,536,089. 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-CCC-3.1.1.3	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	CDFG, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	Cost savings would be significant. Currently a significant amount of large woody material is removed without proper authorization in the San Lorenzo River.
SLR-CCC-3.1.1.4	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	2	100	CDFG, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	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.
SLR-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage the County of Santa Cruz to expand large instream wood structure tracking.	2	10	Santa Cruz County						In-Kind	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-CCC-3.1.1.6	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CalFire, Private Landowners, State Parks	214.00	214.00	214.00	214.00		856	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 \$1,621/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
SLR-CCC-3.1.2.1	Action Step	Habitat Complexity	Target restoration actions in the mainstem reach between the upper Rincon Bend and the Tait Street diversion.	2	10	CDFG, City of Santa Cruz, RWQCB, Santa Cruz County, State Parks	50.00	50.00				100	This area is low gradient and accessible to adult coho salmon during drier water years. Growth potential may be good (although temperatures may be high), is relatively unconfined with deep pools where coho juveniles have been detected in the past. Enhancement opportunities are high at the heads of some of the deeper pools.
SLR-CCC-3.2	Objective	Habitat Complexity	Address other natural or manmade factors affecting the species' continued existence										
SLR-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
SLR-CCC-3.2.1.1	Action Step	Habitat Complexity	Fund a watershed coordinator position.	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, CalTrans, CDFG, 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-CCC-4.1	Objective	Hydrology	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-4.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFG, Lompico Water District, NOAA RC, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, SWRCB, Trout Unlimited							Promoting these type 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.
SLR-CCC-4.1.1.2	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore coho salmon habitat.	2	10	CDFG, 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							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.
SLR-CCC-4.1.1.3	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	CDFG, City of Santa Cruz, IWRP, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB, Trout Unlimited							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.
SLR-CCC-4.1.1.4	Action Step	Hydrology	Investigate the potential for expansion of the Scott Valley water reclamation system.	3	20	City of Scotts Valley, Santa Cruz County						In-Kind	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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-4.1.1.5	Action Step	Hydrology	Investigate water recharge possibilities in Scotts Valley quarries.	3	20	NMFS, Santa Cruz County, SWRCB, USFWS						In-Kind	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-CCC-4.1.1.6	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFG, NMFS, Public, Santa Cruz County, SWRCB						In-Kind	
SLR-CCC-4.1.1.7	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	1	100	Private Landowners, Public, SWRCB						In-Kind	Cost to promote SWRCB review of existing diversions will likely vary between depending on the cooperation of the diverter.
SLR-CCC-4.1.1.8	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							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.
SLR-CCC-4.1.1.9	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	CDFG, IWRP, SWRCB							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 is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed.
SLR-CCC-4.1.1.10	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD							
SLR-CCC-4.1.2	Recovery Action	Hydrology	Minimize redd scour										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-4.1.2.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5		749					749	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 coho egg and alevin mortality. Cost based on \$115,276/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.
SLR-CCC-4.1.3	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
SLR-CCC-4.1.3.1	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-CCC-4.1.3.2	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFG, NMFS, NMFS OLE, Public, SWRCB, Trout Unlimited						In-Kind	
SLR-CCC-4.1.3.3	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	1	100	CDFG, NMFS, Private Landowners, Public, SWRCB						In-Kind	Cost to promote SWRCB review existing diversions will likely vary between depending on the cooperation of the diverter.
SLR-CCC-5.1	Objective	Landscape Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with urbanization										
SLR-CCC-5.1.1.1	Action Step	Landscape Patterns	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, Santa Cruz County, Santa Cruz RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-6.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-6.1.1	Recovery Action	Passage	Improve access of spawning adults and juveniles										
SLR-CCC-6.1.1.1	Action Step	Passage	Remediate passage barriers on mainstem San Lorenzo River.	2	20		60,250	60,250	60,250	60,250		241,000	In general, migration barriers are not the most significant limiting factor to coho salmon 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-CCC-6.1.1.2	Action Step	Passage	Remediate passage barriers in San Lorenzo River tributaries.	2	20	CDFG, 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-CCC-8.1	Objective	Riparian	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-8.1.1	Recovery Action	Riparian	Protect existing riparian areas										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-8.1.1.1	Action Step	Riparian	Work with PG&E to ensure practices do not impair riparian areas.	2	10	CDFG, NMFS, PG&E, Private Landowners, RWQCB, Santa Cruz County							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-CCC-9.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
SLR-CCC-9.1.1.1	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	2	100	CalFire, IWRP, NRCS, Private Landowners, RWQCB, Santa Cruz County, State Parks							Initial focus should be directed at the middle river and adjacent subwatersheds.
SLR-CCC-9.1.1.2	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Lorenzo River.	3	50	California Geological Survey, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD							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.
SLR-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
SLR-CCC-9.1.2.1	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							Initial focus should be directed at the lower reaches of Bean, Zayante, Love, and Newell Creeks.
SLR-CCC-9.1.2.2	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							
SLR-CCC-10.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
SLR-CCC-10.1.1	Recovery Action	Viability	Increase abundance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-10.1.1.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat determined appropriate by NMFS and CDFG.	3	100	CDFG, City of Santa Cruz, NMFS, NOAA SWFSC, Private Consultants						TBD	Standardized monitoring methods should be used to evaluate long-term effectiveness of restoration efforts. Monitoring should likely occur in a few select and representative watersheds. This action is rated a lower priority due to the very low population of coho salmon in the watershed.
SLR-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.	1	10								Re-introduction should only occur in subwatersheds where instream habitat conditions are suitable for all coho salmon lifestages. Conditions evaluated should include: summer flow conditions, cover, winter refugia, pools depths, instream temperature, and gravel quality.
SLR-CCC-10.2	Objective	Viability	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
SLR-CCC-10.2.1.1	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	2	10	Private Consultants, San Lorenzo Valley Water Agency, Santa Cruz County	94.50	94.50				189	Cost for annual juvenile sampling estimated at \$18,823/year for the Santa Cruz Diversity Stratum.
SLR-CCC-10.2.2	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
SLR-CCC-10.2.2.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	15	CDFG, NOAA RC, Private Consultants, San Lorenzo Valley Water Agency, Santa Cruz County	42.33	42.33	42.33			127	Cost for fish/habitat restoration effectiveness monitoring estimated at \$126,758/project.
SLR-CCC-10.2.2.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	100	CDFG, NOAA RC, Public, SWRCB						TBD	
SLR-CCC-10.2.3	Recovery Action	Viability	Increase spawner density										
SLR-CCC-10.2.3.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	10		423.50	423.50				847	Standardized surveys should not occur until a small sustained run of CCC coho salmon is re-established in the watershed. Cost for annual spawner ground surveys estimated at \$56,470/year in the Santa Cruz Diversity Stratum.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-10.2.3.2	Action Step	Viability	Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery.	2	10	CDFG, Monterey Bay Salmon and Trout Project, NMFS	202.50	202.50				405	Cost for adult escapement monitoring estimated at
SLR-CCC-10.3	Objective	Viability	Address other natural or manmade factors affecting the species' continued existence										
SLR-CCC-10.3.1	Recovery Action	Viability	Increase spawner density										
SLR-CCC-10.3.1.1	Action Step	Viability	Supplement existing populations where appropriate, while minimizing departure from the populations historical genetic profile. Evaluate feasibility and benefits of constructing and operating a conservation hatchery for the propagation of CCC coho salmon. Construct and operate the facility is determined to be feasible and beneficial.	1	15	CDFG, NMFS, Public						TBD	The Monterey Bay Salmon and Trout Project operate a coho salmon broodstock program nearby in Scott Creek. The Scott Creek facility is constrained due to its location and cannot easily expand due to financial, physical, and hydrologic constraints, and is not suitable for longterm reintroduction efforts in the San Lorenzo River. A larger facility, located on the San Lorenzo River could serve as a regional conservation hatchery for multiple streams in the Santa Cruz Mountains Diversity Stratum. Possible locations could include Newell Creek below Loch Lomond where a reliable water supply is potentially available. The San Lorenzo River offers numerous potential locations and water quality and quantity should be closely evaluated. As with all such facilities, strict genetic management protocols should be followed. The facility should only be operated for broodstock purposes and not as a production facility.
SLR-CCC-10.3.1.2	Action Step	Viability	Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	2	10	CDFG, Monterey Bay Salmon and Trout Project, NMFS, NOAA SWFSC, Private Landowners						TBD	Imprinting stations will increase the likelihood of adults returning and re-establish a run in targeted sub basins. Approximately five imprinting station may be needed in various tributaries of the San Lorenzo River. Stations should continue until a run is re-established. Suitable locations should be carefully evaluated for their potential to support a viable run.
SLR-CCC-11.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-11.1.1	Recovery Action	Water Quality	Improve instream temperature conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-11.1.1.1	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-CCC-11.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants.										
SLR-CCC-11.1.2.1	Action Step	Water Quality	Implement improved wastewater disposal management through the San Lorenzo Wastewater Management Plan.	3	10	RWQCB, Santa Cruz County						In-Kind	
SLR-CCC-11.1.2.2	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							
SLR-CCC-11.1.2.3	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						In-Kind	This recommendation should be considered standard practice.
SLR-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.
SLR-CCC-11.1.3.1	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							TBD	
SLR-CCC-11.1.3.2	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							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-13.1	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-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						In-Kind	Eliminating gabion baskets will result in long-term cost savings due to implementation of longer lasting and better engineered solutions.
SLR-CCC-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, CDFG, City of Santa Cruz, FEMA, NRCS, Private Landowners, RWQCB, Santa Cruz County, Santa Cruz RCD						In-Kind	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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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						In-Kind	Channelization is one of the largest impacts of urbanization (Mount 1995). 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 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.
SLR-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to instream habitat complexity										
SLR-CCC-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	CalFire, California Geological Survey, CalTrans, CDFG, City of Santa Cruz, FEMA, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-13.1.2.2	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	CDFG, City of Santa Cruz, NMFS, NOAA RC, USACE	10.00	10.00				20	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-CCC-13.2	Objective	Channel Modification	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to habitat complexity										
SLR-CCC-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 in the light of designated Critical Habitat obligations.	2	5	City of Santa Cruz, NMFS, USACE						In-Kind	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.
SLR-CCC-13.2.2	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-13.2.2.1	Action Step	Channel Modification	Modify county regulatory and planning processes to eliminate provisions allowing 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						In-Kind	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.
SLR-CCC-14.1	Objective	Disease/Predation/Competition	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
SLR-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
SLR-CCC-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						100	This will primarily occur through educational and outreach programs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-14.1.1.2	Action Step	Disease/Predation/Competition	Prevent spread of the New Zealand mudsnail from the San Lorenzo River to other adjacent watersheds.	3	10	CDFG, City of Santa Cruz, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County	15.00	15.00				30	This will primarily occur through educational programs.
SLR-CCC-14.2	Objective	Disease/Predation/Competition	Address disease or predation										
SLR-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
SLR-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.	3	10	CDFG, NOAA SWFSC	65.00	65.00				130	Cost for abundance/distribution estimate at \$129,391/project.
SLR-CCC-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 coho salmon survival and abundance.	2	10	CDFG, NMFS, NOAA SWFSC						TBD	Evaluation should include an analysis of potential increases in predator populations (striped bass, sea birds, pinipeds) resulting from annual planting and consequences to coho salmon survival. cost accounted for in above action step.
SLR-CCC-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-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 coho salmon life stages.	2	100	CalFire						In-Kind	This recommendation should be considered a standard practice.
SLR-CCC-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						In-Kind	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
SLR-CCC-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						In-Kind	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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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						In-Kind	Standard business practice.
SLR-CCC-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the San Lorenzo River watershed (and all other watersheds in the County).	2	100	CalFire, Santa Cruz County						In-Kind	Cost of providing the plan is minimal.
SLR-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
SLR-CCC-15.1.2.1	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 DFG 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.
SLR-CCC-15.2	Objective	Fire/Fuel Management	Address the inadequacies of regulatory mechanisms.										
SLR-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
SLR-CCC-15.2.1.1	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							
SLR-CCC-16.1	Objective	Fishing/Collecting	Address the inadequacy or existing regulatory mechanisms										
SLR-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
SLR-CCC-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CDFG						In-Kind	If river mouth has been artificially breached without appropriate authorization, prohibitions on offshore fishing should continue until appropriate flows occur.
SLR-CCC-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	CDFG, City of Santa Cruz, NMFS						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for the San Lorenzo River.	2	5	CDFG, NMFS, Public						In-Kind	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. Additionally, due to the late runs of CCC coho in the streams south of the Golden Gate, the date of opening season should be pushed back to later in the fishing season (currently fishing season starts on December 15) 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.
SLR-CCC-16.1.1.4	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	CDFG, Private Landowners, Santa Cruz County, State Parks							Cost accounted for in ESTUARY.
SLR-CCC-16.1.1.5	Action Step	Fishing/Collecting	Increase oversight on anglers fishing in the San Lorenzo River Gorge to ensure compliance with fishing regulations.	1	100	CDFG, CDFG Law Enforcement, NMFS OLE, Public, State Parks						In-Kind	
SLR-CCC-19.1	Objective	Logging	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-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	CDFG, IWRP, Santa Cruz County, SWRCB						In-Kind	
SLR-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to habitat complexity										
SLR-CCC-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, CDFG, RPFs, Santa Cruz County							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.
SLR-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFG, RPFs, Santa Cruz County						In-Kind	
SLR-CCC-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						In-Kind	Cost is expected to be minimal
SLR-CCC-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, CDFG, RPFs, Santa Cruz County							This action should be considered a high priority within areas composed of Santa Margarita sandstone.
SLR-CCC-19.1.4	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
SLR-CCC-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFG, RPFs, Santa Cruz County							
SLR-CCC-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, CDFG, RPFs, Santa Cruz County							
SLR-CCC-19.1.5	Recovery Action	Logging	Prevent increased landscape disturbance										
SLR-CCC-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, CDFG, RPFs, Santa Cruz County							
SLR-CCC-19.1.6	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, etc.)										
SLR-CCC-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								
SLR-CCC-19.1.6.2	Action Step	Logging	Avoid road construction in riparian zones	2	100	CalFire, CDFG, RPFs, Santa Cruz County							Old roads should not be reopened unless for proper decommissioning purposes.
SLR-CCC-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, CDFG, RPFs, Santa Cruz County							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-19.2.1	Recovery Action	Logging	Prevent impairment to water quality (impaired instream temperature)										
SLR-CCC-19.2.1.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, CDFG, NMFS, RWQCB, Santa Cruz County							Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC ESU) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for coho salmon rearing.
SLR-CCC-19.2.2	Recovery Action	Logging	Prevent increased landscape disturbance										
SLR-CCC-19.2.2.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.	2	20	CalFire, CDFG, Private Landowners, RWQCB						In-Kind	
SLR-CCC-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 coho salmon	3	20	Big Creek Lumber Co., Private Landowners, Red Tree, Redwood Empire							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.
SLR-CCC-19.2.2.3	Action Step	Logging	Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	10	NMFS							The need for this action may change if the California Forest Practice Rules change and reach a no-take standard or the state receives incidental take authorization through the HCP process.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-19.2.2.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.	2	100	CalFire, CDFG, Private Landowners, Santa Cruz County							Installing large woody material into streams deficient in large wood should be considered a top restoration priority, particularly in Core and Priority 1 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.
SLR-CCC-19.2.2.5	Action Step	Logging	Erosion control measures and road maintenance should be maintained during the entire period between re-entries.	2	100	Big Creek Lumber Co., CalFire, CDFG, Private Landowners, Red Tree, Redwood Empire, RPFs, RWQCB							
SLR-CCC-19.2.2.6	Action Step	Logging	Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County							
SLR-CCC-21.1	Objective	Recreation	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-21.1.1	Recovery Action	Recreation	Prevent impairment to passage and migration										
SLR-CCC-21.1.1.1	Action Step	Recreation	Remove all existing summer dams that create a passage impediment to migrating adults or juveniles.	3	30	CDFG, NMFS PRD, NOAA RC, Private Landowners, Public, Santa Cruz County, USACE	359.17	359.17	359.17	359.17	359.17	2,155	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 DFG. All future Corps section 7 consultations should consider impacts to IP-km and the consequence of the action to coho 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 \$143,640/unit.
SLR-CCC-21.1.1.2	Action Step	Recreation	Require monitoring of adult/juvenile passage at summer dam passage facilities.	2	100	CDFG, NMFS, Private Landowners						In-Kind	The cost of monitoring adult/juvenile passage should be incorporated into each summer dam passage facility.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-21.1.1.3	Action Step	Recreation	Implement the most recent NMFS' Guidelines for Summer Dams for all new summer dams seeking 1600 Agreement or Corps 404 permit.	3	100	CDFG, NMFS, NMFS OLE, Private Landowners						In-Kind	Cost should be minimal to use existing guidelines when evaluating summer dams.
SLR-CCC-21.1.2	Recovery Action	Recreation	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-21.1.2.1	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							Cost could be combined with other road assessment priorities in the watershed.
SLR-CCC-21.1.2.2	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	CDFG, City of Santa Cruz, NMFS, NOAA RC, Santa Cruz County, Santa Cruz RCD, State Parks						0	Cost could be offset with other education programs in the County.
SLR-CCC-21.1.2.3	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-CCC-21.2	Objective	Recreation	Address inadequacies of regulatory mechanisms										
SLR-CCC-21.2.1	Recovery Action	Recreation	Prevent impairment to water quality										
SLR-CCC-21.2.1.1	Action Step	Recreation	Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.	3	10	CalFire, Santa Cruz County, Santa Cruz County Land Trust, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-22.1	Objective	Residential/Commercial Development	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
SLR-CCC-22.1.1.1	Action Step	Residential/Commercial Development	New development in all historical CCC coho salmon watersheds should meet a zero net increase 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						In-Kind	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-CCC-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						In-Kind	This recommendation should be considered as a higher priority in subbasins with highly erodible soils (e.g., Santa Margarita sandstone).
SLR-CCC-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						In-Kind	
SLR-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Encourage Santa Cruz County to assess the effectiveness of Sensitive Habitat Ordinance and implement improved performance measures as necessary.	3	5	Santa Cruz County						In-Kind	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).
SLR-CCC-22.1.2.2	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 coho salmon watercourse.	2	100	Private Landowners, Santa Cruz County						In-Kind	

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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						In-Kind	Functional buffers provide multiple benefits to water processes. Buffers in residential areas frequently become compromised overtime due to encroachment issues.
SLR-CCC-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-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-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.
SLR-CCC-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 through a buyout program.	2	100	FEMA, Private Landowners, Santa Cruz County							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.
SLR-CCC-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							Most of these structures have likely been identified. Cost associated with ground truthing and site specific evaluation.
SLR-CCC-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	
SLR-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SLR-CCC-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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-22.1.5	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										Landscape patterns are highly impacted by urbanization which extends along much of the 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.
SLR-CCC-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	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.
SLR-CCC-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.
SLR-CCC-22.2	Objective	Residential/Commercial Development	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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.
SLR-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality										
SLR-CCC-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, Santa Cruz County, USACE						0	Costs should be minimal and are considered part of RWQCB existing authority and obligation.
SLR-CCC-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							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.
SLR-CCC-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							This recommendation should be careful balanced against expansion of rural residential development over a wider landscape.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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							
SLR-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
SLR-CCC-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.	2	10	City of Santa Cruz, City of Scotts Valley, Santa Cruz County							Increasing residential development and road construction increases the impervious surface in the watershed increasing the amount of runoff. This, in combination with reduced instream complexity (LWD formed habitats such as scour pools), increases the likelihood of redd scour during high flow events (Alley et al. 2004). Alley 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 is widespread or whether it is a significant cause of steelhead egg and alevin mortality.
SLR-CCC-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	City of Santa Cruz, City of Scotts Valley, Santa Cruz County							Implementation of this recommendation will help reduce rates of channel incision, increase aquifer recharge, and reduce the likelihood of redd scour.
SLR-CCC-22.2.3.3	Action Step	Residential/Commercial Development	Support the development and implementation of regulations for activities that adversely impact groundwater recharge.	2	10	CDFG, City of Santa Cruz, City of Scotts Valley, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County							
SLR-CCC-22.2.4	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
SLR-CCC-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	City of Santa Cruz, City of Scotts Valley, HUD						0	
SLR-CCC-22.2.4.2	Action Step	Residential/Commercial Development	Discourage Counties from rezoning forestlands to rural residential.	1	100	Santa Cruz County							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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	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.
SLR-CCC-22.2.5	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-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. The County has begun to address this issue by raising some infrastructure subject to frequent flooding in the Felton Grove area.
SLR-CCC-22.2.5.2	Action Step	Residential/Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	Santa Cruz County							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.
SLR-CCC-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to stream hydrology (impaired water flow)										
SLR-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalTrans, City of Scotts Valley, Santa Cruz County							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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
SLR-CCC-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-CCC-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, CDFG, 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-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-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							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. Road 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.
SLR-CCC-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	365.00	365.00				730	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 \$927/mile (assume 75% of road network) and for erosion assessment estimated at \$12/acre (assume 25% of total watershed acres).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-23.1.3.3	Action Step	Roads/Railroads	Reduce erosion from mainline timber harvest roads.	2	20	CalFire, CDFG, 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-CCC-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-CCC-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.
SLR-CCC-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	1,600	1,600	1,600	1,600		6,400	Cost based on treating 25 stream crossings (10% of 258 total) at a rate of \$254,278/unit.
SLR-CCC-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							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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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-CCC-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	In-kind
SLR-CCC-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-CCC-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-CCC-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-CCC-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							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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 Core CCC coho salmon 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-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-23.1.4.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, CalTrans, NRCS, State Parks							
SLR-CCC-23.1.5	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
SLR-CCC-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	275.00	275.00				550	Railcar bridges may result in large cost savings as compared to a seismically engineered bridge structure. Cost based on treating 4 barriers at a rate of \$136,073/crossing.
SLR-CCC-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							Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001).
SLR-CCC-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-CCC-23.1.6	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-23.1.6.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	CalFire, Private Landowners, Santa Cruz County, State Parks							
SLR-CCC-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							
SLR-CCC-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
SLR-CCC-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	350.00					350	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.
SLR-CCC-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							
SLR-CCC-23.2.2	Recovery Action	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.										
SLR-CCC-23.2.2.1	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							

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-23.2.3.1	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							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.
SLR-CCC-23.2.3.2	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	3	20	CalFire, CalTrans, City of Scotts Valley, Santa Cruz County							A well designed road management plan should result in overall cost savings due to lower maintenance costs.
SLR-CCC-23.2.4	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-23.2.4.1	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							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).
SLR-CCC-23.2.4.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	Private Landowners, Santa Cruz County, State Parks							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-23.2.4.3	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	Cost should be considered part of land owner road management plans.
SLR-CCC-23.2.4.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, RWQCB, Santa Cruz County							
SLR-CCC-24.1	Objective	Severe Weather Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
SLR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary (impaired quality and extent)										
SLR-CCC-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	City of Santa Cruz, FEMA, USACE						0	In-Kind
SLR-CCC-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	City of Santa Cruz, FEMA, USACE							
SLR-CCC-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	CA Coastal Commission, City of Santa Cruz, FEMA, USACE							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.
SLR-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions.	2	10	CDFG, City of Santa Cruz, Lompico Water District, NMFS, NMFS OLE, Private Landowners, San Lorenzo Valley Water Agency, SWRCB							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.
SLR-CCC-24.1.2.2	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	CDFG, City of Santa Cruz, NMFS PRD, 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.
SLR-CCC-24.1.2.3	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 by municipal water suppliers and other users in the watershed through conservation programs.	1	20	CDFG, City of Santa Cruz, Lompico Water District, NMFS, NMFS OLE, NRCS, Private Landowners, Public, San Lorenzo Valley Water Agency, Santa Cruz RCD, SWRCB, USFWS							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-CCC-24.1.2.4	Action Step	Severe Weather Patterns	Prohibit filling of all recreational instream summer dams during drought periods.	3	100	CDFG, NMFS OLE							Few recreational dams on the San Lorenzo River are permitted. It is anticipated unpermitted dams may be installed on the River or its tributaries.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.										
SLR-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	1	100	CDFG, City of Santa Cruz, City of Scotts Valley, Private Landowners, San Lorenzo Valley Water Agency, SWRCB							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.
SLR-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
SLR-CCC-24.1.4.1	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							
SLR-CCC-24.1.4.2	Action Step	Severe Weather Patterns	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	CDFG, City of Santa Cruz, NMFS HCD, SWRCB						TBD	
SLR-CCC-24.1.4.3	Action Step	Severe Weather Patterns	Work with CDFG, 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 coho lifestages.	3	10	CDFG, Private Consultants, Santa Cruz County, SWRCB							Costs may include consulting expertise to construct a water budget for the San Lorenzo River.
SLR-CCC-24.1.4.4	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	3	10	CDFG Law Enforcement, NMFS OLE						0	Costs are anticipated to be absorbed into ongoing activities.
SLR-CCC-24.1.4.5	Action Step	Severe Weather Patterns	CDFG, 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 coho salmon.	3	10	CalFire, CalTrans, CDFG, 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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-24.1.4.6	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, CDFG, San Lorenzo Valley Water Agency, Santa Cruz County	200.00	200.00				400	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, Branciforte, 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.
SLR-CCC-24.1.5	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-24.1.5.1	Action Step	Severe Weather Patterns	Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.	3	10	CDFG, NMFS HCD, Santa Cruz County							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-CCC-24.1.5.2	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-CCC-24.1.5.3	Action Step	Severe Weather Patterns	Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.	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.
SLR-CCC-24.1.6	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
SLR-CCC-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 Santa Cruz County.	2	5	CDFG, NMFS HCD, Santa Cruz County							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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
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SLR-CCC-24.1.6.2	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	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.
SLR-CCC-24.1.6.3	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							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.
SLR-CCC-24.1.6.4	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						TBD	
SLR-CCC-25.1	Objective	Water Diversion/Impoundment	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
SLR-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										
SLR-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater, legal and illegal) do not further impair estuary water quality conditions for rearing juvenile salmonids.	1	100	City of Santa Cruz, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB							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-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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							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 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 coho salmon would likely be substantial.
SLR-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).	2	10	CDFG, NMFS HCD, NMFS OLE, NMFS PRD, Private Consultants, SWRCB							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.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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	CDFG, 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-CCC-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, CDFG, 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-CCC-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 Section 1707.	1	20	CDFG, Private Landowners, Santa Cruz County, SWRCB							
SLR-CCC-25.1.2.6	Action Step	Water Diversion/Impoundment	Investigate the potential for expansion of the Scott Valley water reclamation system.	2	15	CDFG, 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.
SLR-CCC-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							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.
SLR-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-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 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							
SLR-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100	CDFG, CDFG Law Enforcement, City of Santa Cruz, Lompico Water District, NMFS, San Lorenzo Valley Water Agency, SWRCB							The Lompico Water District should install adequate fish screens on diversion intakes as soon as possible.
SLR-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
SLR-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure water diversions do not impair water temperatures in the San Lorenzo River.	1	100	City of Santa Cruz, City of Scotts Valley, Lompico Water District, RWQCB, San Lorenzo Valley Water Agency, SWRCB							As part of future 1600 agreement, CDFG 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 CDFG.
SLR-CCC-25.2	Objective	Water Diversion/Impoundment	Address the inadequacy of existing regulatory mechanisms										
SLR-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-25.2.1.1	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	CDFG, NMFS, NMFS OLE, SWRCB						0	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-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	1	1	CDFG, 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 DFG to ensure compliance with streambed alteration agreements (section 1600). Increased oversight by DFG would have the added benefit of addressing not only appropriative diversion but riparian diversions as well.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Petition the SWRCB to declare the Santa Margarita aquifer fully appropriated.	2	10	CDFG, NMFS, Santa Cruz County, SWRCB							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).
SLR-CCC-25.2.1.4	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							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-CCC-25.2.1.5	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	CDFG, NMFS, SWRCB						TBD	
SLR-CCC-25.2.1.6	Action Step	Water Diversion/Impoundment	Prohibit new or increased summer diversions.	1	100	CDFG, 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).

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
SLR-CCC-25.2.1.7	Action Step	Water Diversion/Impoundment	Work with the City of Santa Cruz (and other major diverters) to minimize impacts of their diversions.	1	10	CDFG, City of Santa Cruz, NMFS HCD, NMFS PRD, San Lorenzo Valley Water Agency, SWRCB						TBD	Currently, the City of Santa Cruz is working on a HCP to address impacts.
SLR-CCC-25.2.1.8	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	CDFG, NMFS, San Lorenzo Valley Water Agency						TBD	The San Lorenzo Valley Water District and other major diverters should bring their diversion into ESA compliance and DFG Code 1600 compliance.
SLR-CCC-25.2.1.9	Action Step	Water Diversion/Impoundment	Encourage Lompico Water District to come into compliance with CDFG streambed alteration requirements.										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.
SLR-CCC-25.2.1.10	Action Step	Water Diversion/Impoundment	Identify source of dewatering in Carbonera Creek near the City of Scotts Valley.	2	10	CDFG, CDFG Law Enforcement, City of Scotts Valley, NMFS, NMFS OLE, SWRCB							Upper Carbonera Creek now has major dry back section during the summer. Diversions from nearby wells are suspected.