

Big Salmon Creek



Location	• Mendocino County
Watershed Area	• 13.0 Square Miles
Potential Habitat	• 16.8 Stream Miles
Vegetation	• 71% Coniferous, 16% Grassland or Shrubland
Erodability	• Moderate
Ownership Patterns	• 100% Private
Dominant Land Uses	• Timber
Housing Density	• Moderate
TMDL Pollutants	• None



Big Salmon Creek.
Photo Courtesy: Campbell Timberland Management

Big Salmon Creek Coho Salmon: Persistent – Low Abundance

Recovery Goals

- ✓ Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed

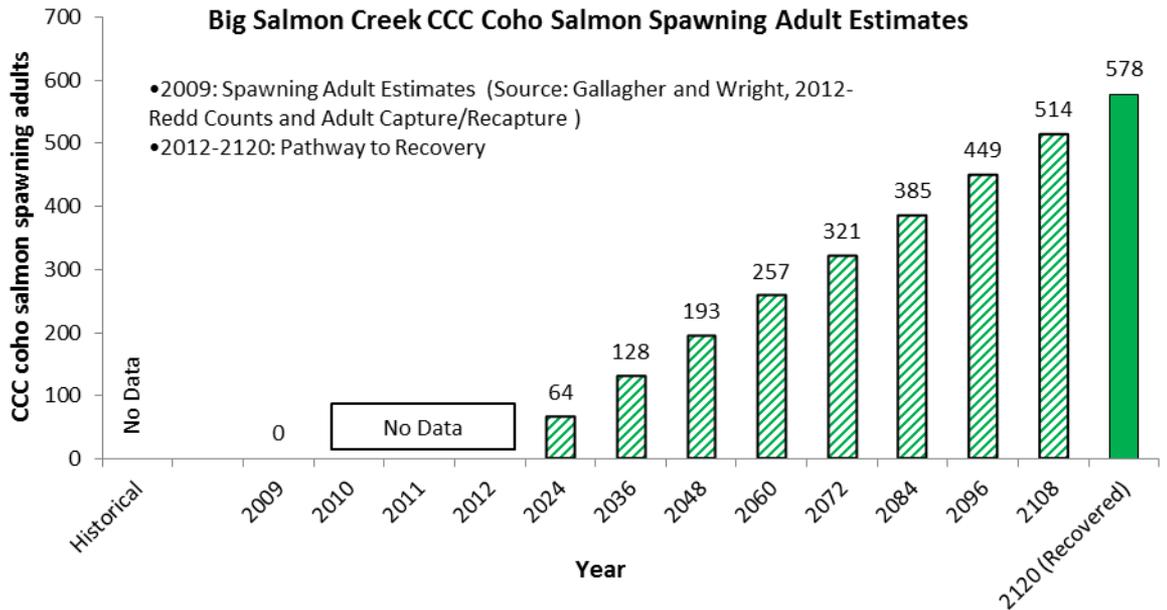


**Big Salmon Creek
Adult Spawner Targets**

**Downlisting to Threatened
289**

**Recovery
578**

**STEELHEAD: YES
CHINOOK SALMON: NO**



Current Instream, Watershed and Population Conditions



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Retain, recruit and actively input large wood into stream

Priority 2 & 3: Long-Term Restoration Actions

- Construct or create alcoves and backwater areas
- Conduct conifer release to promote growth of larger diameter trees where appropriate
- Conduct periodic, standardized juvenile surveys in the watershed
- Develop a Sediment Reduction Plan

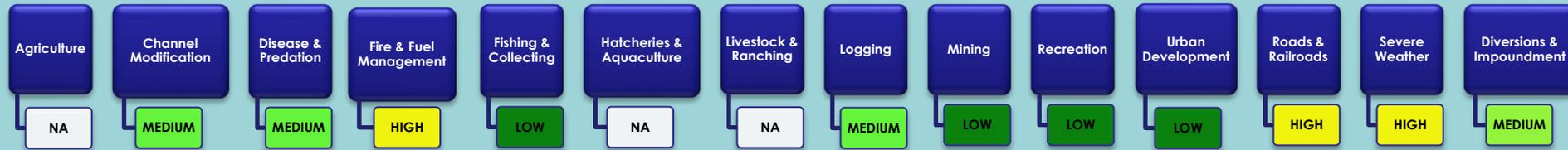


Recovery Partners

THE CONSERVATION FUND

America's Partner in Conservation

Future Threats



Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage home building or other incompatible land use in areas identified as timber production zones
- Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Identify and eliminate depletion of summer base flows from unauthorized water uses

Priority 2 & 3: Long-Term Threat Abatement Actions

- Implement sediment reduction techniques in concert with prescribed fire and fire suppression techniques to minimize sediment impacts
- Timber harvest planning should avoid or minimize adverse impacts to off channel habitats, floodplains, ponds, and oxbows
- Protect headwater channels with larger buffers and encourage tree retention on the axis of headwall swales
- For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations
- Manage riparian areas for their site potential composition and structure
- Encourage timber landowners to implement restoration projects as part of their timber management practices



LWD placement in Big Salmon Creek.

Photo Courtesy: Campbell Timberland Management

Conservation Highlights

- The Conservation Fund recently purchased a 4,350 acre tract of timber from Hawthorne Timber Company, and plans on implementing practices to decrease the intensity of harvests, increase the time between harvests and widen riparian buffers.
- Hawthorne Timber Company had undertaken placement of large woody debris structures and sediment remediation projects.

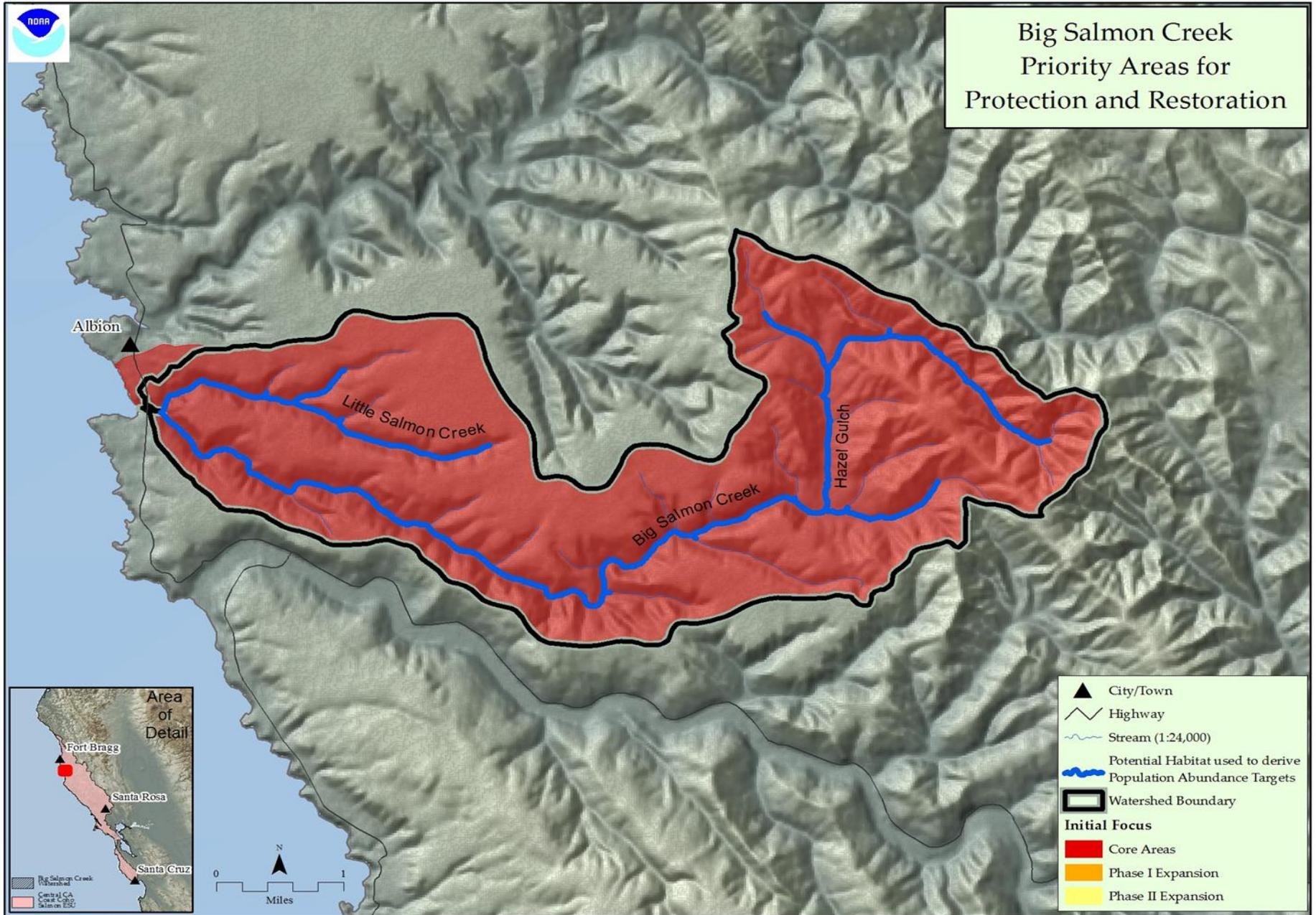


Figure 1: Map of Big Salmon Creek

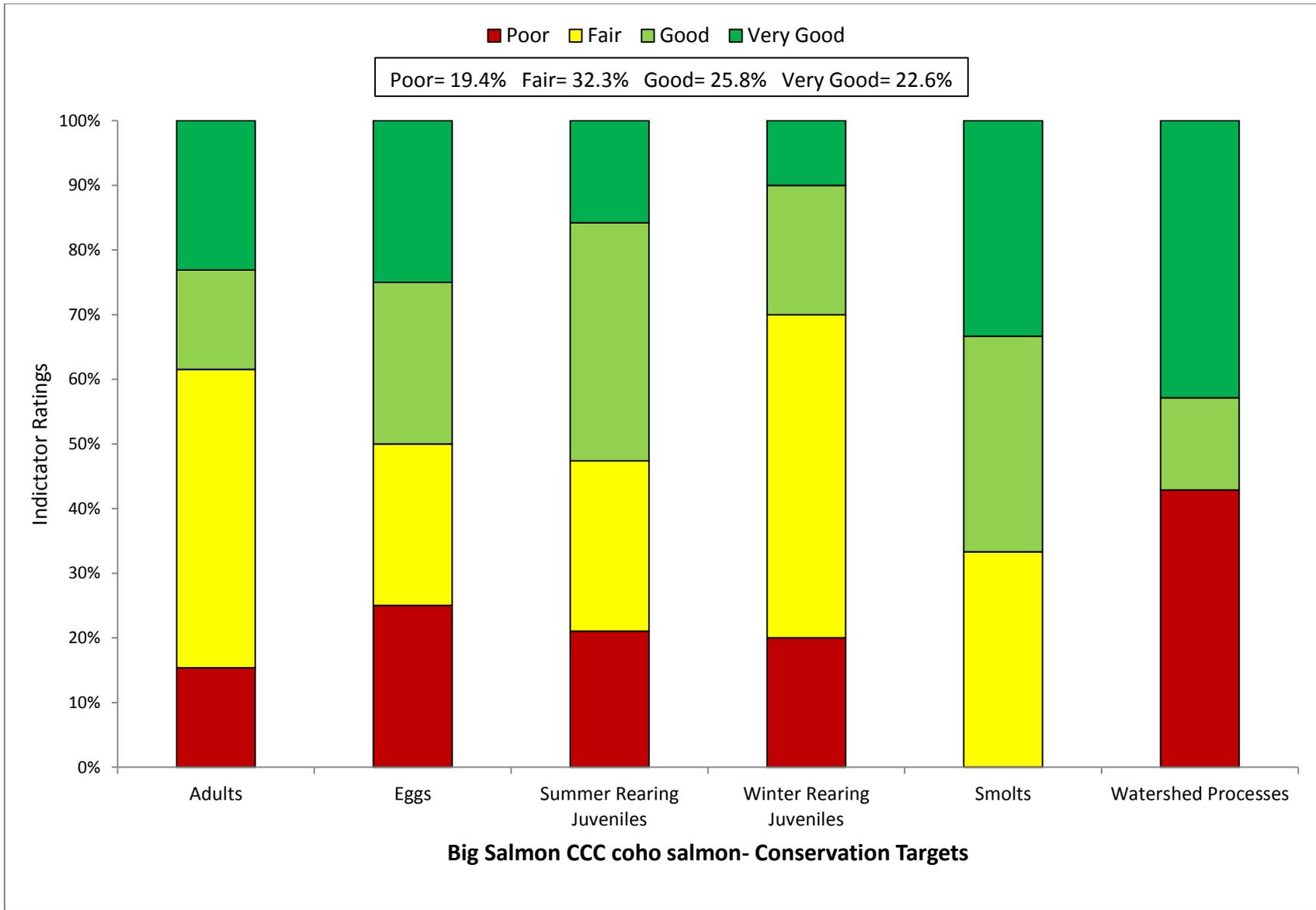


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Big Salmon Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	6.34 Key Pieces/100m	Good	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<1 to 1.3 Key Pieces/100m	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	80% streams; 68% 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	20% streams; 59% IP-km (>80 stream average)	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	Risk Factor Score = <35	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	>90% of IP-km accessible	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	100% of IP-km accessible	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	33% Class 5 & 6 across IP-km	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	50% of IP-km to 74% of IP-km accessible	Fair	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	No Acute or Chronic	Good	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 to < low risk spawner density	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score = <35	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	Risk Factor Score =50	Good	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)	60% streams; 64% IP-km (>50% stream average scores of 1 & 2)	Fair	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	Unimpaired Condition	Very Good	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	6.34 Key Pieces/100m	Good	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 to 1.3 Key Pieces/100m	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-km (>49% of pools are primary pools)	Poor	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	80% streams; 68% 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	20% streams; 59% IP-km (>80 stream average)	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	Risk Factor Score =35-50	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score =35-50	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	0.59 Diversions/10 IP-km	Good	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	100% of IP-km accessible	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	33% of streams/ IP-km (>85% average stream canopy)	Poor	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)	33% Class 5 & 6 across IP-km	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	60% streams; 64% IP-km (>50% stream average scores of 1 & 2)	Fair	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)	75 to 89% IP-km (<16 C MWMT)	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	No Acute or Chronic	Good	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	>90% of Historical Range	Very Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	6.34 Key Pieces/100m	Good	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 to 1.3 Key Pieces/100m	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	80% streams; 68% 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	20% streams; 59% IP-km (>80 stream average)	Fair	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	100% of IP-km accessible	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	33% Class 5 & 6 across IP-km	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	60% streams; 64% IP-km (>50% stream average scores of 1 & 2)	Fair	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	No Acute or Chronic	Good	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	Unimpaired Condition	Very Good	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	20% streams; 59% IP-km (>80 stream average)	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	0.59 Diversions/10 IP-km	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	Risk Factor Score = <35	Very Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	>90% of IP-km accessible	Very 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	No Acute or Chronic	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	0.26% of Watershed in Impervious Surfaces	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	0% of Watershed in Agriculture	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	20% of Watershed in Timber Harvest	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	33% 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	>75% Historical Species Composition	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	7.5 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)	6.1 Miles/Square Mile	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Big Salmon Creek

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

Central CA Coast Coho Salmon ~ Big Salmon Creek

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:** Improve the quality of each estuarine habitat zone

1.1.1.1. **Action Step:** Evaluate current conditions and potential limiting factors in Big Salmon Creek estuary.

2. Restoration- Floodplain Connectivity

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

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.

2.1.1.2. **Action Step:** Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.

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

3.1.1.2. **Action Step:** Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).

3.1.1.3. **Action Step:** Encourage retention and recruitment of large woody debris for all historical CCC coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.2. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.1.2.1. **Action Step:** Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.

4. Restoration- Hydrology

No species-specific actions were developed.

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 road density

5.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

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

5.1.2.1. **Action Step:** Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems

5.1.2.2. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.2.3. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity

8. Restoration- Riparian

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

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

8.1.2. **Recovery Action:** Improve canopy cover

8.1.2.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).

8.1.2.2. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

8.1.2.3. **Action Step:** Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs.

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:** Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

10. Restoration- Viability

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

10.1.1. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.1.1.1. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

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

10.1.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.

10.1.2.2. **Action Step:** Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.

11. Restoration- Water Quality

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

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

11.1.1.1. **Action Step:** Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

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:** Re-contour any new facility sites as soon as possible after site cleanup and fire.
- 15.1.2. **Recovery Action:** Prevent increased landscape disturbance
- 15.1.2.1. **Action Step:** In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.
- 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](#)

No species-specific actions were developed.

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 stream hydrology (impaired water flow)
- 19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion
- 19.1.3. **Recovery Action:** Prevent impairment to habitat complexity
- 19.1.3.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

- 19.1.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
 - 19.1.4.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.
 - 19.1.4.2. **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.
 - 19.1.4.3. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.
 - 19.1.4.4. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.
- 19.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure
 - 19.1.5.1. **Action Step:** Manage riparian areas for their site potential composition and structure.
- 19.1.6. **Recovery Action:** Prevent increased landscape disturbance
 - 19.1.6.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).
- 19.1.7. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, etc.)
 - 19.1.7.1. **Action Step:** Reduce the amount and rate of even aged management.
- 19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
 - 19.2.1. **Recovery Action:** Prevent increased landscape disturbance
 - 19.2.1.1. **Action Step:** Encourage timber landowners to implement restoration projects as part of their timber management practices in stream reaches and where large woody material is deficient. Particular focus should be directed to stream reaches in Hazel and Ketty Gulch.
 - 19.2.1.2. **Action Step:** Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).
 - 19.2.1.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

20. [Threat- Mining](#)

No species-specific actions were developed.

21. [Threat- Recreation](#)

No species-specific actions were developed.

22. [Threat- Residential/Commercial Development](#)

No species-specific actions were developed.

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 watershed hydrology
- 23.1.1.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.
- 23.1.1.2. **Action Step:** Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.
- 23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
- 23.1.2.1. **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).
- 23.1.2.2. **Action Step:** Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.
- 23.1.2.3. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.
- 23.1.2.4. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.
- 23.1.2.5. **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. **Recovery Action:** Prevent impairment to passage and migration
- 23.1.3.1. **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.
- 23.2. **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:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.
- 23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

- 23.2.2.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.
- 23.2.2.2. **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.
- 23.2.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
 - 23.2.3.1. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

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 stream hydrology (impaired water flow)

24.1.1.1. **Action Step:** 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.

24.1.1.2. **Action Step:** Develop offstream water containment sites for water trucks in order to minimize onstream diversions during the summer low flow period.

24.1.1.3. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water uses.

24.1.1.4. **Action Step:** 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. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).

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

24.1.2.1. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

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

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Big Salmon Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BSC-CCC-1.1.1	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
BSC-CCC-1.1.1.1	Action Step	Estuary	Evaluate current conditions and potential limiting factors in Big Salmon Creek estuary.	3	10	California Coastal Conservancy, CDFG, Conservation Fund, NMFS	137.00	137.00				274	Cost is ultimately dependent on scope and extent of the limiting factors analysis. Cost based on estuary use/residence timing at a cost of \$273,217. The study should include recommendations to address potential limiting factors. Big Salmon has an estuary that does not bar over during the summer low flow period. Comparisons between steelhead utilization and coho utilization in an open estuarine environment could also be evaluated.
BSC-CCC-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority. Cost for fish/habitat monitoring is estimated at \$111,192/project.
BSC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
BSC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	10	CalFire, Conservation Fund, Public, RWQCB	30.00	30.00				60	
BSC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.	2	10	CDFG, Conservation Fund, Private Landowners	23.00	23.00				46	This recommendation is more feasible within Big Salmon Creek watershed because a large portion of the watershed is owned by one landowner and most of the roads in adjacent to fish bearing watercourses are used exclusively for timber harvest activities. Many of these roads are dirt and most are used infrequently and viable alternative routes likely exist in many subbasins. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 12 miles of road at a rate of \$12,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-3.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BSC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
BSC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	5	CalFire, CDFG, Conservation Fund, Private Landowners	125.00					125	
BSC-CCC-3.1.1.2	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	100	CalFire, CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-3.1.1.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical CCC coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
BSC-CCC-3.1.2.1	Action Step	Habitat Complexity	Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.	2	10	CDFG, Conservation Fund, Private Landowners	0.06	0.06				0	Historical logging practices effectively removed all of the original conifer overstory (principally redwood) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for Big Salmon Creek watershed suggests that riparian stands are relatively well stocked, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Cost is based on treating 1 mile (assume 80 acres/mile in 15% High IP) at a rate of \$1,422/mile. Cost is expected to be minimal because most of the watershed is subject to active timber management.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
BSC-CCC-5.1	Objective	Landscape Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range											
BSC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with road density										Cost cannot be estimated because overall amount of landowner participation is unknown (particularly for conservation easements).	
BSC-CCC-5.1.1.1	Action Step	Landscape Patterns	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	10	CalFire, Conservation Fund, Private Landowners	72.50	72.50				145	Particular attention should be directed at implementing this action along mainstem. Mainstem temperatures are very warm, particularly in the lower reaches, and it will take a considerable time to grow the riparian canopy to sufficient size to add in overall stream shading. Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of \$20,057/acre.	
BSC-CCC-5.1.2	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance											
BSC-CCC-5.1.2.1	Action Step	Landscape Patterns	Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems	3	100	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners							In-Kind	
BSC-CCC-5.1.2.2	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	3	100	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners							In-Kind	
BSC-CCC-5.1.2.3	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	3	100	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners							In-Kind	Some roads have been rocked - often through the timber harvest process and these costs should be considered an ongoing operation expense and grant funds should be used sparingly excepting where critical needs exist on discrete problematic road segments. Big Salmon Creek lacks many readily available rock sources and rock will likely need to be imported from a location outside the basin.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-8.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										Timber harvest remains a threat to coho salmon habitat in Big Salmon Creek, but at diminished levels compared to historical practices. Even with application of new California Forest Practice Rules this threat is anticipated to continue.
BSC-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter										
BSC-CCC-8.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CalFire, Conservation Fund, Private Landowners	28.50	28.50	28.50	28.50		114	Cost dependent on feasibility of surface road treatments for each road use and geology.
BSC-CCC-8.1.2	Recovery Action	Riparian	Improve canopy cover										
BSC-CCC-8.1.2.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	20	CDFG, Conservation Fund, Private Landowners						TBD	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 of trees left for future recruitment should be considered.
BSC-CCC-8.1.2.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CDFG, Conservation Fund, Private Landowners	80.25	80.25	80.25	80.25		321	
BSC-CCC-8.1.2.3	Action Step	Riparian	Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs.			CDFG, Conservation Fund, Private Landowners						In-Kind	This recommendation should be considered standard practice.
BSC-CCC-9.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										Many roads in the watershed have inside ditches. Cost should be considered part of road maintenance costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										Active and abandoned logging roads and skid trails exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but additional work remains before impairment is minimized. An effective road program should include a component that closes and remediates unnecessary roads and skid trails in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed and, based on the low rate of projected harvest in the watershed, the potential for sediment (both through chronic input and large episodic events) is high. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules. Cost based on road assessment for 92 miles (assume 75% of road network) at a cost of \$927/mile.
BSC-CCC-9.1.1.1	Action Step	Sediment	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).	3	20	CDFG, Conservation Fund, Private Landowners						In-Kind	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Road inventory should identify extent and need for energy dissipaters.
BSC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										Costs may vary widely depending on number of riparian roads and the magnitude of the problem associated with the roads. Focus initial efforts (and/or continue ongoing efforts) in Hazel Gulch and Ketty Gulch. Cost accounted for in LANDSCAPE PATTERNS.
BSC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CDFG, Conservation Fund, Private Landowners						TBD	
BSC-CCC-10.1	Objective	Viability	Address the inadequacy of existing regulatory mechanisms										
BSC-CCC-10.1.1	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
BSC-CCC-10.1.1.1	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	100	CDFG, NMFS, Private Consultants, RFFI, State Parks						In-Kind	Cost based on stream flow modeling at a cost of \$63,000.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										Cost will likely be captured within future timber harvest operational costs and compliance with 1600 streambed alteration agreements. At least two sites have already been constructed in Big Salmon Creek watershed. Due to low summer baseflows in Big Salmon Creek, this recommendation may reduce direct take of listed salmonids that may otherwise result from water truck diversions, particularly in dry years.
BSC-CCC-10.1.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	3	9		3.33	2.67				6	Low summer baseflows are present in Big Salmon Creek watershed. This baseline condition results in increased vulnerability of rearing juvenile coho salmon to diversions. Rates of diversion may increase in Big Salmon Creek watershed due to reduced rates of timber harvest (resulting in reduced oversight of some of the ownership in the watershed) and increasing rates of illegal (and legal) cannabis (marijuana) crops in Mendocino County.
BSC-CCC-10.1.2.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.	2	10	CDFG, Conservation Fund	2.50	2.50				5	Most diversions in Big Salmon watershed for dust control are for timber management actions. Most of these diversion have a 1600 agreement with the Department of Fish and Game and are likely incorporated into existing operations.
BSC-CCC-11.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species range or habitat										
BSC-CCC-11.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										This recommendation should be considered standard practice.
BSC-CCC-11.1.1.1	Action Step	Water Quality	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, CDFG, Conservation Fund, Private Landowners						TBD	Assess high-risk shallow seeded landslide areas, prioritize, and develop plans to rehabilitate.
BSC-CCC-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BSC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	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		
BSC-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, CDFG, Conservation Fund, Private Landowners						In-Kind	Many of these types of roads are present in Big Salmon Watershed. Cost based on decommissioning 5 miles of riparian road network at a rate of \$12,000/mile.
BSC-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, CDFG, Conservation Fund, Private Landowners						In-Kind	Use techniques that will require minimal management. Cost based on treating 1.25 miles (assume 1 project/mile in 25% High IP) at a rate of \$36,046/mile.
BSC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
BSC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire						In-Kind	Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat according to shelter rating values. LWD was likely removed during past land management activities and well intentioned stream clearing practices. However, since these surveys were conducted, some efforts to improve instream habitat conditions have been conducted in the mainstem portions of Big Salmon Creek. While significant efforts have occurred, it is likely that instream habitat conditions overall are not at the viability targets for these attributes. Due to the lack of downstream infrastructure in Big Salmon Creek, it is assumed that most of the instream structure will consist of LWD and that most of this structure will be left unanchored. LWD should consist of logs 1.5 to 2 times the bankfull channel width. Cost based on treating 2.5 miles (assume 1 project/mile in 50% High IP) at a rate of \$25,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-15.2	Objective	Fire/Fuel Management	Address the inadequacies of regulatory mechanisms.										To implement this recommendation, additional streamlining of the THP process for LWD input by regulatory agencies is necessary. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. In the stream reaches of Big Salmon Creek where there is extremely little downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation. Costs may vary significantly due to stream access, varying paucity of large wood between sub-watersheds, and installation techniques. Big Salmon Creek has been habitat typed and thus the stream reaches lacking wood can be readily identified. Projects occurring as part of ongoing timber harvest actions will have lower overall costs resulting in significant cost savings compared to restoration projects occurring absent timber management equipment already nearby.
BSC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										This recommendation should be considered standard practice.
BSC-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							
BSC-CCC-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										

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		
BSC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels.
BSC-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	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	
BSC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										
BSC-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						TBD	
BSC-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to habitat complexity										
BSC-CCC-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, CDFG, Conservation Fund, RPFs						In-Kind	Cost based on surveying 5 miles of High IP at a rate of \$1,150/mile.. It is assumed that only sporadic sampling will occur in the Big Salmon Creek watershed due to its status as a Dependent watershed, and the overall magnitude of ongoing sampling occurring elsewhere in the Lost Coast Diversity stratum. Cost are estimated from survey methods developed by Gallagher and Gallagher (2005).
BSC-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										Cost based on periodic juvenile sampling (preferably snorkel counts) by trained biologist. Assume reach-scale surveys during summer months to identify presence/absence.
BSC-CCC-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments		
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration			
BSC-CCC-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							In-Kind		
BSC-CCC-19.1.4.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB	13.00	13.00					26	Cost for sediment assessment accounted for in LOGGING.	
BSC-CCC-19.1.4.4	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB								In-Kind	
BSC-CCC-19.1.5	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure												Past logging resulted in a conversion of the forests from a redwood/Douglas-fir to many large brushy areas of ceanothus. These areas, while transitioning back to conifers, are at risk of burning. The juxtaposition of rural residential housing on the ridge tops may predispose Big Salmon Creek at greater risk of fire. The combination of younger conifer and hardwoods likely leaves some portions of the Big Salmon Creek watershed more vulnerable to wildfire than under historical conditions.
BSC-CCC-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB								In-Kind	This recommendation should be considered a standard practice.
BSC-CCC-19.1.6	Recovery Action	Logging	Prevent increased landscape disturbance												This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
BSC-CCC-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB								In-Kind	Standard business practice.
BSC-CCC-19.1.7	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, etc.)												

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
BSC-CCC-19.1.7.1	Action Step	Logging	Reduce the amount and rate of even aged management.	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							In-Kind	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watershed locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
BSC-CCC-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms											
BSC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance											
BSC-CCC-19.2.1.1	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their timber management practices in stream reaches and where large woody material is deficient. Particular focus should be directed to stream reaches in Hazel and Ketty Gulch.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							In-Kind	
BSC-CCC-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CalFire, Mendocino County, Private Landowners, Public							0	
BSC-CCC-19.2.1.3	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CalFire, Mendocino County, NMFS, Private Landowners							0	
BSC-CCC-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range											This recommendation should be considered standard practice.
BSC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology											Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identify areas for prioritization. Cost based on erosion assessment (assume 25% of total watershed acres) estimated at \$12/acre.
BSC-CCC-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							In-Kind	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
BSC-CCC-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							In-Kind	
BSC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)											This recommendation should be considered standard practice.
BSC-CCC-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							TBD	
BSC-CCC-23.1.2.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							In-Kind	Where feasible, this recommendation should be considered standard practice.
BSC-CCC-23.1.2.3	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB	43.00	43.00					86	
BSC-CCC-23.1.2.4	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							TBD	This recommendation should be considered standard practice.
BSC-CCC-23.1.2.5	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, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB								
BSC-CCC-23.1.3	Recovery Action	Roads/Railroads	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)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. 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. Many landowners are discouraged from implementing these practices due complexities in the permitting process.
BSC-CCC-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
BSC-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.										
BSC-CCC-23.2.1.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFG, NRCS, RWQCB, USACE						In-Kind	
BSC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
BSC-CCC-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	All new and replacement culverts should be sized to accommodate a 100 year flow event. This recommendation should be considered standard practice.
BSC-CCC-23.2.2.2	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.	1	10	CalFire, CDFG, Conservation Fund, RPFs, RWQCB						In-Kind	These will likely be replaced as part of future timber harvest plans in Big Salmon watershed.
BSC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
BSC-CCC-23.2.3.1	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Legacy roads from past logging activity continue to impact Big Salmon Creek watershed. Many of these roads were poorly situated and constructed, improperly maintained, and many have been abandoned.
BSC-CCC-24.1	Objective	Severe Weather Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
BSC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFG, Conservation Fund, Private Landowners	31.50	31.50				63	
BSC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Develop offstream water containment sites for water trucks in order to minimize onstream diversions during the summer low flow period.	2	10	CalFire, Conservation Fund, Private Landowners						In-Kind	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
BSC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFG, CDFG Law Enforcement, Conservation Fund, NMFS OLE, Sheriff Department, SWRCB						TBD	
BSC-CCC-24.1.1.4	Action Step	Severe Weather Patterns	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. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CDFG, Conservation Fund, Private Landowners						TBD	Preservation of remaining migration zones are a high priority due to their importance for various salmonid life stages. Protection of these areas will potentially help facilitate future restoration actions. Old roads (and rail road grades) should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to Class 1 streams with high IP value habitat.
BSC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										This recommendation should be considered standard practice.
BSC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CDFG, Conservation Fund, Private Landowners						TBD	Cost should be considered part of land owner road management plans. Frequent monitoring of gates and potential pioneer trails will likely be an ongoing requirement in Big Salmon watershed.