

Pine Gulch Creek



Location	• Sonoma County
Watershed Area	• 17.0 Square Miles
Potential Habitat	• 11.4 Stream Miles
Vegetation	• 50% Coniferous, 22% Riparian, 13% Grassland
Erodability	• Moderate
Ownership Patterns	• 22% Private, 78% Public
Dominant Land Uses	• Recreation
Housing Density	• Low to Moderate
TMDL Pollutants	• Sediment, Temperature, Nutrients, Pathogens, Metals



Pine Gulch Creek
Photo National Park Service, Point Reyes

Pine Gulch Creek Coho Salmon: Nearly Extirpated



Recovery Goals

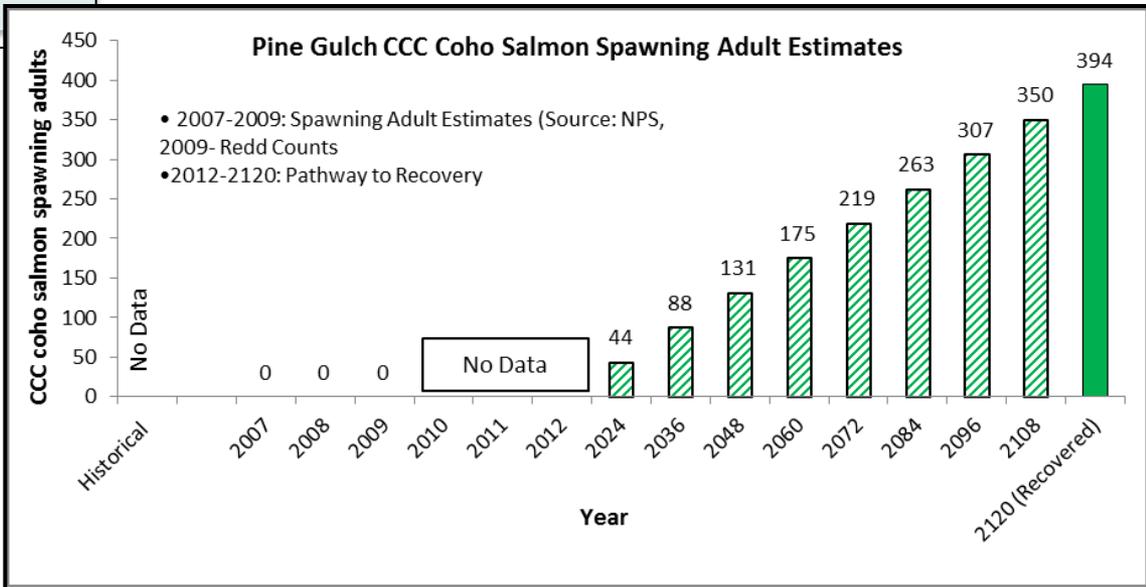
- ✓ Expand fish and habitat monitoring programs

**Pine Gulch Creek
Adult Spawner Targets**

**Downlisting to Threatened
197**

**Recovery
394**

**STEELHEAD: YES
CHINOOK SALMON: NO**



Current Instream, Watershed and Population Conditions



Preventing Extinction & Improving Conditions

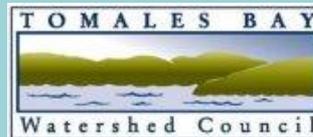
Priority 1: Immediate Restoration Actions

- Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically
- Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the Coastal Diversity Stratum

Priority 2 & 3: Long-Term Restoration Actions

- Increase capacity of estuarine habitat and continue restoration efforts in Bolinas Lagoon
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats and complex habitat features
- Counties and municipalities should adopt a policy of “managed retreat”
- Investigate the feasibility of beaver re-location and re-introductions
- Address season of diversion, off-stream reservoirs, and bypass flows to be more protective of coho salmon

Recovery Partners



Future Threats



Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Address sediment sources from road networks and other actions delivering sediment to stream channels
- Implement exclusion fencing and off-stream water storage



Landslide near Pine Gulch Creek
Photo by National Park service, Point Reyes

Priority 2 & 3: Long-Term Threat Abatement Actions

- Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows
- Implement relevant high priority treatments from the PWA assessment. Promote road decommissioning when feasible
- Work with land owners or public agencies to acquire water for instream flows to minimize adverse effects of droughts to salmonids
- Promote the use of reclaimed water for agricultural or other uses
- Adequately screen water diversions to prevent juvenile salmonid mortalities

Conservation Highlights

- Private landowners are augmenting flow through off-channel storage in Pine Gulch Creek to improve hydrology for coho salmon

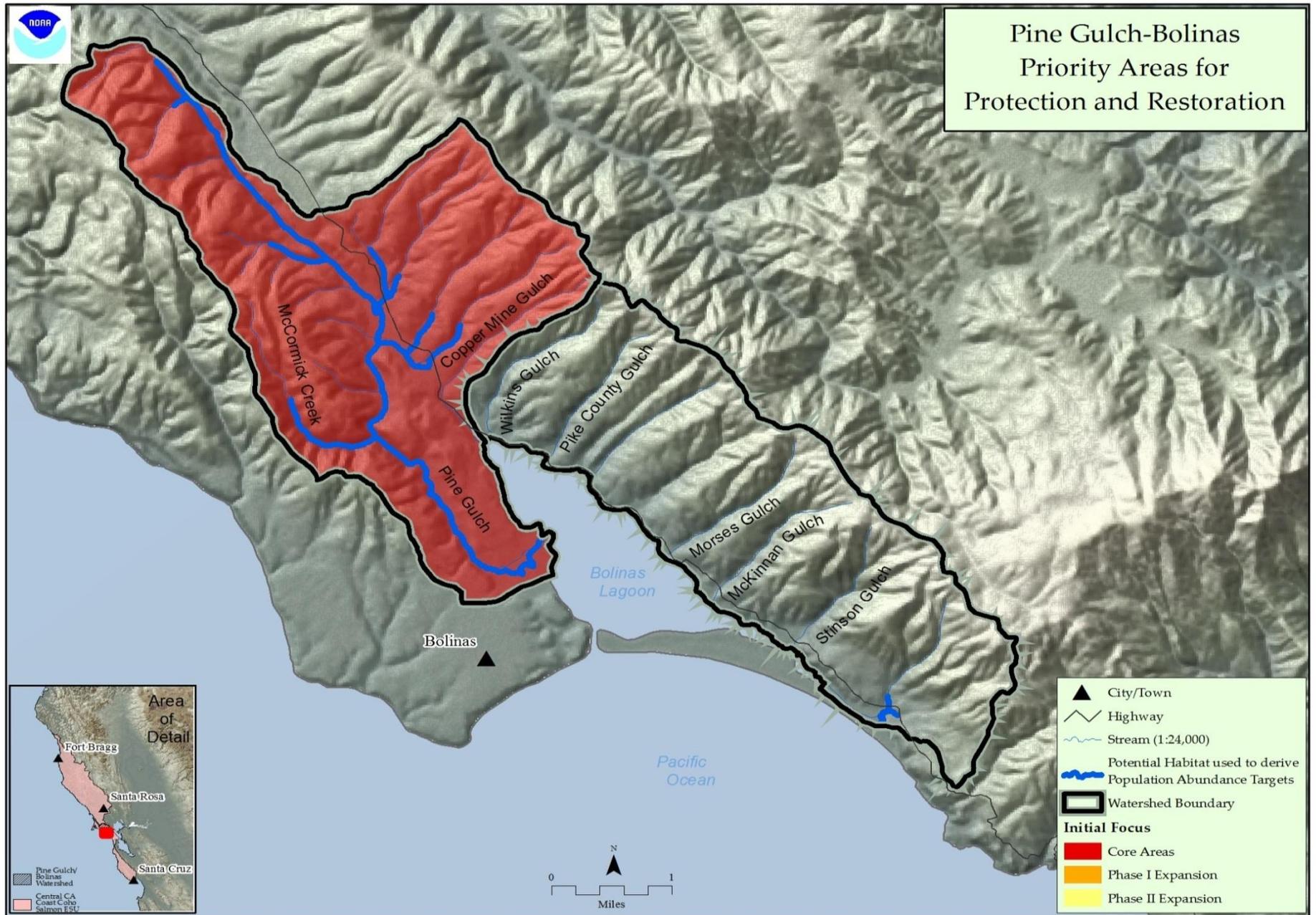


Figure 1: Map of Pine Gulch Creek
 Pine Gulch Creek

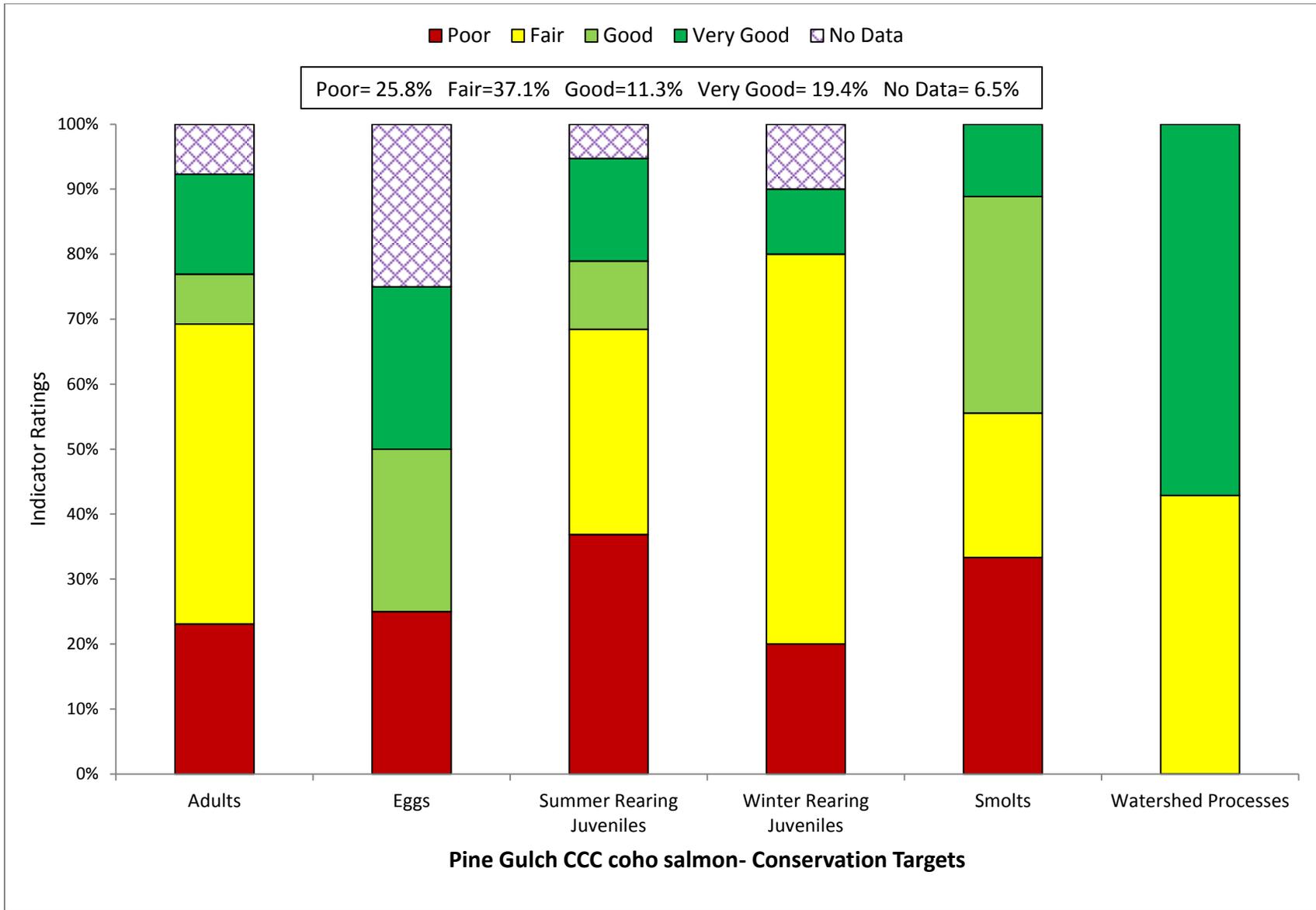


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Pine Gulch Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	4 to 6 Key Pieces/100m	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	NA	0	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	50% to 74% of streams/ 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	<50% of streams/ 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	>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	96% 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)	3% 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	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	Sublethal or Chronic	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	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 (Reference Spence)	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score =42	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	Risk Factor Score = <35	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	ND	0	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	0% streams 0% 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/non-functional	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	4 to 6 Key Pieces/100m	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	NA	0	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	50% to 74% of streams/ 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	<50% of streams/ 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 =58	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score =42	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	2.58 Diversions/10 IP-km	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	>90% of IP-km accessible	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	96% 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	<50% 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)	3% 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)	50% to 74% of streams/ 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	Sublethal or Chronic	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	>90% of streams/ IP-km maintains severity score of 3 or lower	Very Good	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 to 6 Key Pieces/100m	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	NA	0	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	50% to 74% of streams/ 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	<50% of streams/ 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	96% 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)	3% 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)	50% to 74% of streams/ 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	Sublethal or Chronic	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Poor	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	<50% of streams/ 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	2.58 Diversions/10 IP-km	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	Risk Factor Score =50	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	Sublethal or Chronic	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good	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	1.65% of Watershed in Impervious Surfaces	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	20% of Watershed in Agriculture	Fair	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	<10% of Watershed in Timber Harvest	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	6% of watershed >1 unit/20 acres	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	25-50% Historical Species Composition	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	1.4 Miles/Square Mile	Very Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	0.9 Miles/Square Mile	Fair	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile
Winter Rearing	Water Quality	Turbidity	0.9 Miles/Square Mile	Fair	Newcombe and Jensen 2003	>74% of IP km maintains severity score of 3 or lower

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

Cental CA Coast Coho Salmon ~ Pine Gulch 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:** Increase the extent of estuarine habitat
 - 1.1.1.1. **Action Step:** Increase capacity of estuarine habitat in Bolinas Lagoon according to the recommendations in the Gulf of the Farallones National Marine Sanctuary preferred alternative.
 - 1.1.1.2. **Action Step:** Continue restoration efforts on Bolinas lagoon to benefit coho salmon during all life phases and seasons.

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:** Increase and enhance velocity refuge
 - 2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.
 - 2.1.1.2. **Action Step:** Restore channel function in the lower watershed to create off channel habitat.
 - 2.1.1.3. **Action Step:** Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.
- 2.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
 - 2.2.1. **Recovery Action:** Increase and enhance velocity refuge
 - 2.2.1.1. **Action Step:** Counties and municipalities should adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

3. 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:** Improve shelter rating
 - 3.1.1.1. **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 and Phase I areas first.
 - 3.1.2. **Recovery Action:** Increase frequency of primary pools
 - 3.1.2.1. **Action Step:** Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (CDFG 2004).

3.1.3. **Recovery Action:** Improve habitat complexity

3.1.3.1. **Action Step:** Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations

4. Restoration- Hydrology

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

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

4.1.1.2. **Action Step:** Implement the Pine Gulch Creek Watershed Enhancement Project. The proposed project includes appropriation of water to storage during the winter season, controlled riparian diversion between April and July 1, and no diversion between July 1 and December 15 of each year.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

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 canopy cover

8.1.1.1. **Action Step:** Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for coho salmon (CDFG 2004).

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

8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.

8.1.2.3. **Action Step:** Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.

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:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Reduce embeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)

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

9.1.1.3. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels. (See ROADS). Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).

9.1.1.4. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).

9.1.1.5. **Action Step:** Implement DS level actions and BMP's

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:** Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population.

10.1.1.2. **Action Step:** Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the DS, while minimizing departure from the genetic profile that historically existed in the population.

10.1.2. **Recovery Action:** Increase spawner density by monitoring the population status for response to recovery actions.

10.1.2.1. **Action Step:** Conduct instream habitat assessment where there are data gaps to develop restoration recommendations

10.1.2.2. **Action Step:** Conduct upslope watershed assessments to define limiting factors. Encourage all major landowners to participate

10.1.3. **Recovery Action:** Increase spatial structure and diversity

10.1.3.1. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.3.2. **Action Step:** Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.

10.1.3.3. **Action Step:** Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed

11. Restoration- Water Quality

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

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

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

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

11.2.1. **Recovery Action:** Improve stream temperature conditions

11.2.1.1. **Action Step:** Assess the water temperature regime during the summer season for three to five years to determine the role of water temperature as a limiting factor in coho salmon production (CDFG 2004).

11.2.1.2. **Action Step:** Plant native vegetation to promote streamside shade.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

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

13.1.1. **Recovery Action:** Prevent impairment of floodplain connectivity

13.1.1.1. **Action Step:** All proposed development projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.

13.1.1.2. **Action Step:** Counties and municipalities should adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

13.1.1.3. **Action Step:** Encourage counties to develop a Sensitive Habitat Ordinance

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

13.2.1. **Recovery Action:** Prevent impairment of floodplain connectivity

13.2.1.1. **Action Step:** Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow “emergencies”.

13.2.1.2. **Action Step:** Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. [Threat- Fire/Fuel Management](#)

No species-specific actions were developed.

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](#)

No species-specific actions were developed.

20. [Threat- Mining](#)

No species-specific actions were developed.

21. [Threat- Recreation](#)

No species-specific actions were developed.

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 watershed hydrology

22.1.1.1. **Action Step:** Implement actions in ROADS and RAILROADS

22.1.1.2. **Action Step:** Implement DS level Actions

22.1.2. **Recovery Action:** Prevent impairment to floodplain connectivity

22.1.2.1. **Action Step:** Implement actions in FLOODPLAIN

22.1.2.2. **Action Step:** Implement DS level actions

22.1.3. **Recovery Action:** Prevent impairment to riparian species and composition

22.1.3.1. **Action Step:** Implement actions in RIPARIAN

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

22.1.4.1. **Action Step:** Implement actions in WATER DIVERSIONS

22.1.4.2. **Action Step:** Implement DS level actions

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

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

22.2.1.1. **Action Step:** Implement DS level actions and BMP's

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 alterations to sediment transport (road condition/density, dams, etc.)

23.1.1.1. **Action Step:** Reevaluate the high priority treatment recommendations for unpaved roads from the PWA assessment, and implement recommended treatments if they are still relevant. If not, reassess and make new recommendations for treatment. Push for decommissioning when feasible.

23.1.1.2. **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.

23.1.2. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.1.2.1. **Action Step:** NMFS and other stakeholders will work with RCD or NRCS to encourage hiring of consultants to conduct road assessments (first for subwatersheds in Core areas, then for Phase I areas).

23.1.2.2. **Action Step:** Address sediment sources from road networks and other actions that deliver sediment to stream channels.

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

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

23.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.2.1.1. **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).

24. Threat- Severe Weather Patterns

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

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.

24.1.1.2. **Action Step:** All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.

25. Threat- Water Diversion/Impoundment

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

25.1.1. **Recovery Action:** Prevent impacts from future water development

25.1.1.1. **Action Step:** Develop off channel water storage for farming operation within the watershed to increase summer pool habitat in the lower portion of the watershed.

25.1.1.2. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

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

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

26. [Threat- Watershed Process](#)

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Pine Gulch 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	
PGC-CCC-1.1	Objective	Estuary	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
PGC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
PGC-CCC-1.1.1.1	Action Step	Estuary	Increase capacity of estuarine habitat in Bolinas Lagoon according to the recommendations in the Gulf of the Farallones National Marine Sanctuary preferred alternative.	2	40	CDFG, Golden Gate National Recreation Area, Gulf of the Farallones National Marine Sanctuary, Marin County, Marin County Open Space District, USACE						TBD	
PGC-CCC-1.1.1.2	Action Step	Estuary	Continue restoration efforts on Bolinas lagoon to benefit coho salmon during all life phases and seasons.	2	10	CDFG, Golden Gate National Recreation Area, Gulf of the Farallones National Marine Sanctuary, Marin County, Marin County Open Space District, NMFS	1,550	1,550				3,100	Cost based on treating 10% of 1,140 acres of estuary habitat at a rate of \$272,120/acre.
PGC-CCC-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
PGC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
PGC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, NMFS, NPS	22.50	22.50				45	Cost based on treating 1.25 miles (assume 1 project/mile in 25% High IP) at a rate of \$36,046/mile.
PGC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Restore channel function in the lower watershed to create off channel habitat.	2	10	CDFG, NMFS, NPS	25.50	25.50				51	Cost based on treating 25% of 2 miles of lower Pine Gulch at a rate of \$101,120/mile.
PGC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.	2	20	NPS						TBD	

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	
PGC-CCC-2.2	Objective	Floodplain Connectivity	Address the inadequacy of existing regulatory mechanisms										
PGC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
PGC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	20	FishNet 4C, Marin County							TBD
PGC-CCC-3.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
PGC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve shelter rating										
PGC-CCC-3.1.1.1	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 and Phase I areas first.	2	40	CDFG, NMFS, NPS							Cost are encumbered in increase shelter rating.
PGC-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
PGC-CCC-3.1.2.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (CDFG 2004).	2	10	CDFG, NMFS, NPS	25.00	25.00				50	Cost based on treating 10% of 5 miles of stream at a rate of \$101,120/ELJ.
PGC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve habitat complexity										
PGC-CCC-3.1.3.1	Action Step	Habitat Complexity	Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations	2	10		5.00	5.00				10	Cost for beaver re-introduction based on estimate at \$10,000/beaver family translocation.
PGC-CCC-4.1	Objective	Hydrology	Address the inadequacy of existing regulatory mechanisms										
PGC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										

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		
PGC-CCC-4.1.1.1	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	20	CDFG, Marin County, SWRCB							In-Kind	
PGC-CCC-4.1.1.2	Action Step	Hydrology	Implement the Pine Gulch Creek Watershed Enhancement Project. The proposed project includes appropriation of water to storage during the winter season, controlled riparian diversion between April and July 1, and no diversion between July 1 and December 15 of each year.	2	40	CDFG, Marin County, Private Landowners, State Water Resources Control Board							TBD	
PGC-CCC-8.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range											
PGC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover											
PGC-CCC-8.1.1.1	Action Step	Riparian	Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for coho salmon (CDFG 2004).	2	20	CDFG, NMFS, NPS	400.00	400.00	400.00	400.00			1,600	Cost based on treating 0.5 miles (assume 80 acres/mile in 5% High IP with 1 mile minimum) at a rate of \$20,057/acre.
PGC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter											
PGC-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	30	, CDFG, NMFS							TBD	Cost likely accounted for in above action steps.
PGC-CCC-8.1.2.2	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.	2	20	, CDFG, NMFS							TBD	Cost likely accounted for in above action steps.
PGC-CCC-8.1.2.3	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	2	10	Marin RCD, MMWD							In-Kind	
PGC-CCC-9.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.											
PGC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.											

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	
PGC-CCC-9.1.1.1	Action Step	Sediment	Reduce embeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)	2	10		56.00	56.00				112	Cost based on fish/habitat monitoring estimated at \$111,192/project.
PGC-CCC-9.1.1.2	Action Step	Sediment	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	10		31.50	31.50				63	Cost based on road inventory estimated at \$927/mile and sediment assessment estimated at \$12/acre (assume 25% of total watershed acres)..
PGC-CCC-9.1.1.3	Action Step	Sediment	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels. (See ROADS). Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).	2								TBD	Cost accounted for in above action step.
PGC-CCC-9.1.1.4	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	2	10		12.00	12.00				24	Cost based on decommissioning 2 miles of riparian road network at a rate of \$12,000/mile
PGC-CCC-9.1.1.5	Action Step	Sediment	Implement DS level actions and BMP's	3									
PGC-CCC-10.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
PGC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
PGC-CCC-10.1.1.1	Action Step	Viability	Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population.	1		CDFG, NMFS PRD, NPS, State Parks, Trout Unlimited, UC Extension						TBD	
PGC-CCC-10.1.1.2	Action Step	Viability	Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the DS, while minimizing departure from the genetic profile that historically existed in the population.	1		CDFG, NMFS, NPS, State Parks, Trout Unlimited, UC Extension						TBD	
PGC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density by monitoring the population status for response to recovery actions.		40	NPS						TBD	Continue to support ongoing monitoring efforts by NPS

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		
PGC-CCC-10.1.2.1	Action Step	Viability	Conduct instream habitat assessment where there are data gaps to develop restoration recommendations	3	5		2.70					3	Cost based on habitat typing survey estimated at \$333/IP km.
PGC-CCC-10.1.2.2	Action Step	Viability	Conduct upslope watershed assessments to define limiting factors. Encourage all major landowners to participate	3	10							TBD	Cost likely accounted for in sediment assessment.
PGC-CCC-10.1.3	Recovery Action	Viability	Increase spatial structure and diversity										
PGC-CCC-10.1.3.1	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10							In-Kind	
PGC-CCC-10.1.3.2	Action Step	Viability	Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.	1	10	, CDFG, USACE						TBD	
PGC-CCC-10.1.3.3	Action Step	Viability	Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed	2	5	, CDFG, Marin RCD, NMFS						In-Kind	
PGC-CCC-11.1	Objective	Water Quality	Address the inadequacy of existing regulatory mechanisms.										
PGC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
PGC-CCC-11.1.1.1	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	20	NPS						TBD	
PGC-CCC-11.2	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
PGC-CCC-11.2.1	Recovery Action	Water Quality	Improve stream temperature conditions										
PGC-CCC-11.2.1.1	Action Step	Water Quality	Assess the water temperature regime during the summer season for three to five years to determine the role of water temperature as a limiting factor in coho salmon production (CDFG 2004).	3	5	NPS						TBD	

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		
PGC-CCC-11.2.1.2	Action Step	Water Quality	Plant native vegetation to promote streamside shade.	2	20		402.50	402.50	402.50	402.50		1,610	Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with 1 mile minimum) at a rate of \$20,057/acre.
PGC-CCC-13.1	Objective	Channel Modification	Address the inadequacy of existing regulatory mechanisms										
PGC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment of floodplain connectivity										
PGC-CCC-13.1.1.1	Action Step	Channel Modification	All proposed development projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.	2	10	Marin County, NPS, Private Landowners						TBD	
PGC-CCC-13.1.1.2	Action Step	Channel Modification	Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	20	Marin County							In-Kind
PGC-CCC-13.1.1.3	Action Step	Channel Modification	Encourage counties to develop a Sensitive Habitat Ordinance	2	10	Marin County							In-Kind
PGC-CCC-13.2	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
PGC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment of floodplain connectivity										
PGC-CCC-13.2.1.1	Action Step	Channel Modification	Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow "emergencies".	2	10	NPS							In-kind
PGC-CCC-13.2.1.2	Action Step	Channel Modification	Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.	2	10	Marin County, Marin RCD, NPS	62.50	62.50				125	Cost based on \$25,000/mile for 5 miles of stream with 1 project/mile.
PGC-CCC-22.1	Objective	Residential/Commercial Development	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
PGC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										

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	
PGC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Implement actions in ROADS and RAILROADS	2									
PGC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Implement DS level Actions	3									
PGC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity										
PGC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Implement actions in FLOODPLAIN	2									
PGC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Implement DS level actions	3									
PGC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										
PGC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Implement actions in RIPARIAN	2									
PGC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
PGC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Implement actions in WATER DIVERSIONS	2									
PGC-CCC-22.1.4.2	Action Step	Residential/Commercial Development	Implement DS level actions	3									
PGC-CCC-22.2	Objective	Residential/Commercial Development	Address the inadequacy of existing regulatory mechanisms.										
PGC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
PGC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Implement DS level actions and BMP's	3									

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	
PGC-CCC-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
PGC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent alterations to sediment transport (road condition/density, dams, etc.)										
PGC-CCC-23.1.1.1	Action Step	Roads/Railroads	Reevaluate the high priority treatment recommendations for unpaved roads from the PWA assessment, and implement recommended treatments if they are still relevant. If not, reassess and make new recommendations for treatment. Push for decommissioning when feasible.	2	10		235.00	235.00				470	Cost based on treating 14 miles of road network at \$21,000/mile. Cost to decommission road network to viability targets is \$168,000.
PGC-CCC-23.1.1.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	50							In-Kind	
PGC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PGC-CCC-23.1.2.1	Action Step	Roads/Railroads	NMFS and other stakeholders will work with RCD or NRCS to encourage hiring of consultants to conduct road assessments (first for subwatersheds in Core areas, then for Phase I areas).	2	50							TBD	Cost accounted for in road and sediment assessment.
PGC-CCC-23.1.2.2	Action Step	Roads/Railroads	Address sediment sources from road networks and other actions that deliver sediment to stream channels.	2	20							TBD	Cost likely accounted for in sediment assessment.
PGC-CCC-23.1.2.3	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	3	10		22.00	22.00				44	Cost based on decommissioning 4 miles of road network at \$12,000/mile.
PGC-CCC-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
PGC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										

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	
PGC-CCC-23.2.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	50							In-Kind	
PGC-CCC-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
PGC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
PGC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	2	10	Marin RCD						TBD	
PGC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.	2	20	Marin County, NPS						TBD	
PGC-CCC-25.1	Objective	Water Diversion/Impoundment	Address the inadequacy of existing regulatory mechanisms										
PGC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impacts from future water development										
PGC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Develop off channel water storage for farming operation within the watershed to increase summer pool habitat in the lower portion of the watershed.	2	30	California Coastal Conservancy, CDFG, Marin County, Private Landowners, State Water Resources Control Board						TBD	Cost depend on landowner participation.
PGC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	20	Marin County, Marin RCD, NRCS, State Water Resources Control Board						In-Kind	
PGC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										

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	
PGC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100						In-Kind	This recommendation should be considered standard practice.