Big River

Big River

Independent Population
191.8 IP-Km of potential coho salmon habitat
Coho salmon, Chinook salmon, and steelhead present

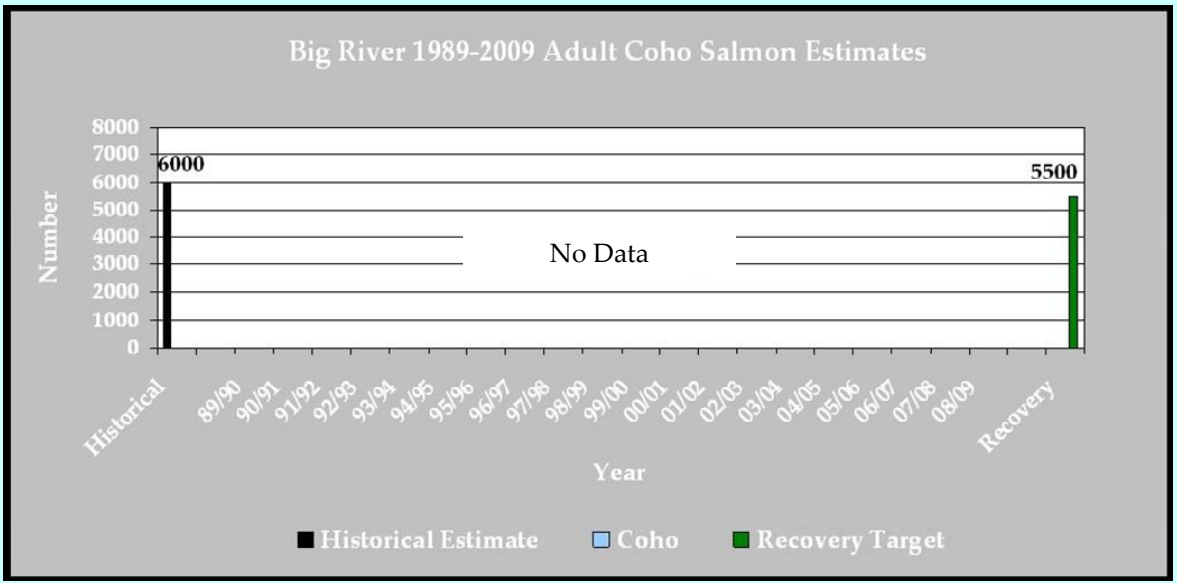
Big River drains approximately 181 square miles of the California Coast Range in western Mendocino County. Big River enters the Pacific Ocean at the town of Mendocino. An eight mile long estuary is located in the western edge of the basin. About 64 percent of the Big River watershed is redwood coniferous forest and about 14 percent of the watershed area is montane hardwood forest. About 72 percent of the Big River watershed has moderately-high to high erodibility after considering slope, precipitation, and the susceptibility of failure of underlying geology. About 77 percent of the Big River watershed is in private ownership. Most of the public land within the watershed is state forest lands and both state parks land. The dominant land use within the Big River watershed is forestry. Within the past 10 years, about 14 percent of the Big River watershed has been under a timber harvest plan. The EPA listed Big River as having water quality impaired for sediment and high water temperature in 2001. The water quality impairment listing determined that sediment was impairing the migration, spawning, reproduction and early development of coho salmon and other salmonids, and identified non-point source forestry as the probable cause. Since then, the EPA has established a TMDL for the watershed. Housing development within the Big River watershed is moderate – about 290 housing units are present in the watershed.

We Want Your Photo Here

Big River
Photo © Your Name Here, AFFIL

The Watershed at a Glance

Spawning Quantity & Quality:	**VERY GOOD**
Summer Water Temperatures:	**POOR**
Depth & Shelter of Pools	**POOR**
Large Wood Frequency:	**POOR**
Riparian Canopy:	**POOR to FAIR**
off channel/Floodplain Quality:	**POOR to FAIR**
Estuary Function:	**FAIR**



Big River

Recovery Target: 5,500 Adult Coho Salmon

Increasing the survival of coho salmon

requires **protecting** all individuals from threats that are jeopardizing coho salmon. The highest ranked threats are:

- Logging and wood harvesting
- Roads throughout the watershed
- Storms and Flooding

Preventing the extinction of coho salmon

means **restoring** many key habitat attributes within the Big River watershed that are in poor condition. The highest priorities for restoration are to:

- Improve pool habitat
- Increase pool frequency
- Improve complex off channel habitats
- Reduce sources of sediment
- Increase large woody debris frequency
- Increase riparian shade to cool streams
- Reduce the amount of roads near the riparian area

Failed road in Big River watershed
Photo courtesy of the KRIS Information System, Big River project.

Advancing recovery of coho

salmon in Big River requires these priority **recovery actions:**

- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.
- Install properly sized large woody debris to appropriate locations.
- Decommission riparian roads and/or upgrade roads (and skid trails on forestlands) that deliver sediment to adjacent watercourses.
- Provide for watershed processes by promoting long term sustainable forestry practices that support coho salmon.
- Undertake a focused effort to improve roads and legacy sediment sources to improve future instream conditions.

. . . in these **core areas:** Russell Brook Creek area of the Russell Brook planning watershed; Dark Gulch, James Creek, East Branch North Fork Big River, and Berry Gulch planning watersheds; Two Log Creek area of the Two Log Creek planning watershed

Conservation Highlights

- California State Parks, Blencowe Forestry, Trout Unlimited (TU), and the NOAA Restoration Center collaborated on placement of large woody debris in the watershed.
- Mendocino Redwood Company, the Conservation Fund, California State Parks, and Coastal Ridges have upgraded roads, and improved passage at undersized or poorly designed crossings.

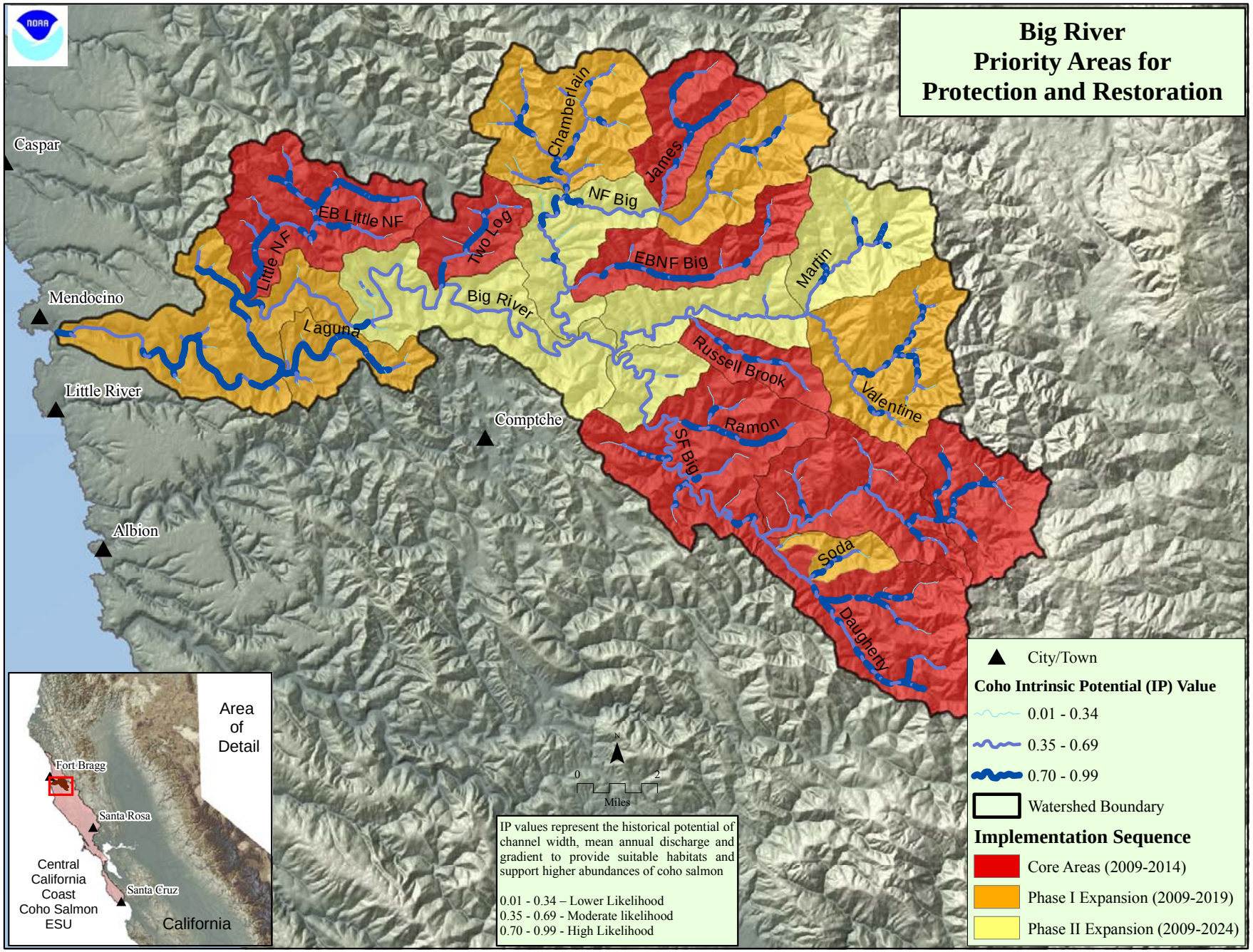
Improved culvert crossing of James Creek.
Photo courtesy of Mendocino County.

Immediate Needs

√ Continuing collaborative restoration efforts
√ Identify a watershed coordinator for this basin
√ Address road sediment input
√ Finalize MRC Habitat Conservation Plan.

Recovery Partners:

DFG
NOAA Restoration Center
California State Parks
Blencowe Forestry
Trout Unlimited
Mendocino Land Trust


Big River
Priority Areas for
Protection and Restoration
Caspar
Mendocino
Little River
Albion
Comptche
Chamberlain
James
NF Big
EB Little NF
Little NF
Two Log
EBNF Big
Martin
Big River
Laguna
Russell Brook
Valentine
Ramon
SF Big
Soda
Daugherty
City/Town
Coho Intrinsic Potential (IP) Value
0.01 - 0.34
0.35 - 0.69
0.70 - 0.99
Watershed Boundary
Implementation Sequence
Core Areas (2009-2014)
Phase I Expansion (2009-2019)
Phase II Expansion (2009-2024)
N
0
2
Miles
IP values represent the historical potential of channel width, mean annual discharge and gradient to provide suitable habitats and support higher abundances of coho salmon
0.01 - 0.34 – Lower Likelihood
0.35 - 0.69 - Moderate likelihood
0.70 - 0.99 - High Likelihood
Area of Detail
Fort Bragg
Santa Rosa
Central California Coast Coho Salmon ESU
Santa Cruz
California

CCC Coho Salmon
Big River
CAP Viability Table Results

Analyst	Source	Result	Rating	Target	Habitat Attribute	Indicator	Poor	Fair	Good	Very Good
Flow Panel	Decision Matrix	33	Good	Spawning Adults	Hydrology	Passage Flows	>75 (score)	51-75	35-50	<35
SEC	PSMFC Database	99%	Very Good	Spawning Adults	Passage	Physical Barriers	<50% of IP-km	50-70% of IP-km	70-90% of IP-km	>90% of IP-km
NCWAP	Decision Matrix	>90 days	Very Good	Spawning Adults	Passage	Passage at Mouth	<30 days	30-60 days	60-90 days	>90 days
SEC	CDFG HAB 8	78787 m^2	Very Good	Spawning Adults	Sediment	Amount of Gravel*	<900 m^2	900-7700 m^2	7700-14500 m^2	>14500 m^2
NMFS	Best Prof. Judgment	<5%	Good	Spawning Adults	Viability	Freshwater Harvest	>10% of pop.	5-10%	<5%	
Flow Panel	Decision Matrix	Good	Good	Eggs	Hydrology	Instantaneous Condition	>75 (score)	51-75	35-50	<35
Flow Panel	Decision Matrix	58	Fair	Eggs	Hydrology	Redd Scour	>75 (score)	51-75	35-50	<35
SEC	Many Sources	NA	Fair	Eggs	Sediment	Gravel Quality (Bulk)	>17% 0.85mm and or >30% 6.3mm	15-17% 0.85	12-14% 0.85mm and or <30% 6.3mm	<12% 0.85
SEC	CDFG HAB 8	43%	Fair	Eggs	Sediment	Gravel Quality (Embeddedness)	<25% of scores 1s&2s	25-50% of scores 1s&2s	>50% of scores 1s&2s	
Flow Panel	Decision Matrix	Fair	Fair	Summer Rearing	Hydrology	Baseflow	>75 (score)	51-75	35-50	<35
SEC	CDFG HAB 8	36.9	Poor	Summer Rearing	Pool Habitat	Shelter Rating	<60 avg. rating	60-80	80-100	>100
SEC	CDFG HAB 8	4%	Poor	Summer Rearing	Pool Habitat	Primary Pools	<30% pools by length	30-40%	40-50%	>50%
SEC/NMFS	Many Sources	NA	Poor	Summer Rearing	Water Quality	Temperature	>30% of IP > 17 C MWMT	Does not meet Good or Very Good	30-60% of IP < 15C MWMT	>60% of IP < 15C MWMT
SEC	CDFG HAB 8	36.9	Poor	Winter Rearing	Floodplain	Complex Habitat**	<50% Connected	50-80% Connected	>80% connected	
NMFS	NCWAP	Fair	Fair	Smolts	Estuary	Estuary				
Flow Panel	Decision Matrix	35-50	Good	Smolts	Hydrology	Passage Flows	>75 (score)	51-75	35-50	<35
SEC	SWRCB	0.03/10Ip-km	Good	Smolts	Passage	# of Diversions**	>5 / 10 IP km	1.1-5	0.01-1	0
SEC	CDFG HAB 8	36.9	Poor	Multiple Life Stages	Pool Habitat	Shelter Rating	<60 avg. rating	60-80	80-100	>100
NMFS	Best Prof. Judgment	50-80%	Fair	Multiple Life Stages	Floodplain	Floodplain Connectivity	<50%	50-80%	>80%	not defined
NMFS	CDF CWHR	59%	Good	Multiple Life Stages	Hydrology	Stand Age			>40 years old	
SEC	NLCDB	0.07%	Very Good	Multiple Life Stages	Hydrology	Impervious Surfaces	>12.01% of WS by area	7.01-12%	3.01-7%	0-3%
SEC	FMMP	0%	Very Good	Multiple Life Stages	Land disturbance	Agriculture	>30% of WS by area	10-30%	0.1-10%	<0.1%
NMFS	CDF THP Dataset	16%	Good	Multiple Life Stages	Land disturbance	Timber Harvest	>35% of WS by area	25 - 35%	10 - 25%	<10%
SEC	Many Sources	3/100m	Poor	Multiple Life Stages	Pool Habitat	LWD Freq. (BFW 0-10)	<4key pcs/100m	4-6/100m	6-11/100m	>11/100m
SEC	Best Prof. Judgment	NA	Poor	Multiple Life Stages	Pool Habitat	LWD Freq. (BFW 10-100)	<1/100m	1-1.3/100m	1.3-4/100m	>4/100m
NMFS	CDF CWHR	25-50%	Fair	Multiple Life Stages	Riparian Veg.	Species Composition	<25%	25-50%	>50%	Historical Conditions
NMFS	CDF CWHR	34%	Poor	Multiple Life Stages	Riparian Veg.	DBH	<39% Class 5 and 6	40-54%	55-69%	>69%
SEC	CDFG HAB 8	83%	Fair	Multiple Life Stages	Riparian Veg.	Canopy Cover	<75 % avg. over IP-km	75-85%	85-95%	>95%
NMFS	CDF THP Dataset	6.4 mi/sq mi.	Poor	Multiple Life Stages	Sediment Transport	Road Density	>3 miles/sq. mile	3 to 2.5	2.5 to 1.6	<1.6
NMFS	CDF THP Dataset	6.9 mi/sq mi	Poor	Multiple Life Stages	Sediment Transport	Road density 100	>1 miles/sq. mile	1-0.5	0.5-0.1	<0.1
NMFS	Many Sources	Fair	Fair	Multiple Life Stages	Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No evidence of toxins or Contaminants
NMFS	Best Prof. Judgment	<1 per IP-km	Poor	Spawning Adults	Viability	Adult Density	<1 per IP-km	1-20 per IP-km	20-40 per IP-km	>40 per IP-km
NMFS	Best Prof. Judgment	< 0.2 fish/m^2	Poor	Summer Rearing	Viability	Juvenile Density	< 0.2 fish/m^2	0.2-0.5 fish/m^2	0.5-1.0 fish/m^2	>1.0 fish/m^2
NMFS	Best Prof. Judgment	20-34%	Fair	Summer Rearing	Viability	Juvenile Distribution	<20% IP-km occupied	20-34%	35-50%	>50%

See Appendix C for a full description of the analysis methods for the Viability Table Reports

* = watershed specific numbers

** = Ratings defined by the distribution of results

Big River Threats Across Targets		Spawning Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Multiple Life Stages			Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	7	8	
1	Logging and Wood Harvesting	Medium	Medium	High	High	High	High			High
2	Roads and Railroads	High	Medium	High	Medium	Medium	High			High
3	Storms and Flooding	Medium	Medium	Medium	Medium	High	Medium			High
4	Droughts	Medium	Low	High	Medium	Medium	Medium			Medium
5	Channel Modification	Medium	Medium	Medium	Medium	Medium	Medium			Medium
6	Climate Change	Medium	Low	Medium	Medium	Medium	Medium			Medium
7	Fire and Fuel Management	Medium	Low	Medium	Medium	Medium	Medium			Medium
8	Recreational Areas and Activities	Medium	Low	Low	Medium	Medium	Medium			Medium
9	Residential and Commercial Development	Medium	Low	Low	Medium	Medium	Medium			Medium
10	Water Diversion and Impoundment	Low	Low	Medium	Medium	Medium	-			Medium
11	Mining	Low	Low	Low	Medium	Low	Low			Low
12	Agricultural Practices	Low	Low	Low	Medium	Low	-			Low
13	Livestock Farming and Ranching	Low	Low	Low	Medium	Low	-			Low
14	Disease, Predation, and Competition	Medium	-	-	-	-	-			Low
15	Fishing and Collecting	Low	-	-	Low	Low	-			Low
16	Hatcheries and Aquaculture	-	-	-	Low	Low	Low			Low
Threat Status for Targets and Project		High	Medium	High	High	High	High	-	-	Very High *

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-2.1	Objective	Floodplain	Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.										
BR-A-2.1.1	Recovery Action	Floodplain	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, and use streamway concept where appropriate.										
BR-A-2.1.1.1	Action Step	Floodplain	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2c	10	CDFG, MMWD, SPAWN	10.00	10.00	10.00	10.00	10.00	100	Existing program (e.g. SPAWN) could be expanded at minimal cost. Estimate additional monitoring costs at $10K/year.
BR-A-2.1.1.2	Action Step	Floodplain	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	3	10	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, State Parks						TBD	Costs depend on level of technical assistance required and types of projects proposed. Many salmon recovery efforts and management programs are currently ongoing. It is possible that there could be additional salmon restoration costs identified based on recovery needs of the species; however, at this time we do no have sufficient information to estimate those potential costs or identify the actions under which they might fall.
BR-A-2.1.1.3	Action Step	Floodplain	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	20	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited						TBD	Initiate projects should target stream reaches with high IP-km values, however, consideration should be also given to mainstem Big River, particularly mainstem reaches above the estuary.
BR-A-3.1	Objective	Hydrology	Improve survival at all life stages by restoring the historical, spatial, and temporal pattern of surface flows.										
BR-A-3.1.1	Recovery Action	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.										
BR-A-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	3	60	California Coastal Conservancy, CDFG, NMFS, NOAA RC, Private Consultants, Private Landowners, SWRCB						TBD	Costs may be significant due to large amount of infrastructure often required to implement this action. However, the benefits to public trust resources in the watershed would likely be significant, particularly if this action prioritizes key tributaries where diversions are concentrated (e.g., South Fork Big River).
BR-A-3.1.1.2	Action Step	Hydrology	Promote diversion devices designed per NMFS Guidelines.	2	60	CDFG, NMFS, Private Landowners, SWRCB, USACE						0	These guidelines should be adopted by the SWRCB and DFG when permitting any diversion. Outreach to existing diverters is also recommended.
BR-A-3.1.2	Recovery Action	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.										
BR-A-3.1.2.1	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFG, CDFG Law Enforcement, NMFS OLE, Private Landowners, SWRCB						TBD	
BR-A-3.1.2.2	Action Step	Hydrology	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (DFG 2004).	2	10	CDFG, NMFS, Private Landowners, SWRCB, USFWS						0	Cost of additional coordination is expected to be minimal.
BR-A-3.1.2.3	Action Step	Hydrology	Require compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	60	NMFS, NMFS OLE, Private Landowners, SWRCB						TBD	Further analysis is needed to determine cost to landowners to comply with guidelines for new diversions.

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-3.1.3	Recovery Action	Hydrology	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential coho streams (DFG 2004).										
BR-A-3.1.3.1	Action Step	Hydrology	Assess and map water diversions (DFG 2004).	2	2	CDFG, NMFS, SWRCB	10.00	10.00				20	Rough cost estimate for Big River watershed only. This exercise should include Riparian and Appropriative diversions. The majority of the estimated cost would result from attempting to identify unreported Riparian diversions.
BR-A-3.1.3.2	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (DFG 2004).	2	10	SWRCB						TBD	Additional analysis needed.
BR-A-3.1.3.3	Action Step	Hydrology	Require streamflow gauging devices to determine the current streamflow condition.	2	10	NMFS, SWRCB, USGS	30.00	30.00	30.00	30.00	30.00	300	Cost based on 30k per year for two stations. This information could provide baseline information that would be useful in evaluating changes to baseflow over time.
BR-A-3.1.4	Recovery Action	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (DFG 2004).	3	60	CDFG, NOAA RC, Private Landowners, SWRCB						TBD	Number of landowners willing to participate is unknown.
BR-A-3.1.5	Recovery Action	Hydrology	Work with SWRCB and landowners to improve over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches currently impacted by water diversion.										
BR-A-3.1.5.1	Action Step	Hydrology	Protect instream flows in all Core areas including the Little North Fork, Two Log Creek, James Creek, East Branch North Fork Big River, Russell Brook, and the upper South Fork Big River.	1	60	CalFire, CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, NMFS OLE, Private Landowners, SWRCB						TBD	
BR-A-6.1	Objective	Pool Habitat	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility.										
BR-A-6.1.1	Recovery Action	Pool Habitat	Encourage the development and implementation of large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (DFG 2004).										
BR-A-6.1.1.1	Action Step	Pool Habitat	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.	1	5	California Coastal Conservancy, CDFG, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks						TBD	These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority.

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-6.1.1.2	Action Step	Pool Habitat	Fund a watershed coordinator.	2	5	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, RCD, RWQCB, State Parks, Trout Unlimited	50.00	50.00	50.00	50.00	50.00	250	Currently, Big River is managed by five or six larger landowners - including State, private, and non-profit. A coordinator is likely necessary to focus actions and resources in key areas and to apply for grants that will span multiple landowners.
BR-A-6.1.1.3	Action Step	Pool Habitat	Install properly sized large woody debris to appropriate viability table targets.	1	20	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, UC Extension	100	100	100	100	100	2,000	Costs may vary significantly due to access, varying paucity of large wood between sub-watersheds, and installation techniques. Much of Big River has been habitat typed and thus the stream reaches lacking wood can be readily identified. Permitting should be streamlined because of programmatic biological opinions for these types of actions. Many key areas in Big River have been targeted for LWD enhancement through the MRC HCP and on JDSF and total costs may be significantly less than projected.
BR-A-6.1.1.4	Action Step	Pool Habitat	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CalFire, CDFG, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, NRCS, Private Landowners, RWQCB, State Parks						TBD	Costs will vary with site specific conditions (such as access and availability of materials). However, significant cost saving could result if projects are implemented when other land management action are planned.
BR-A-7.1	Objective	Riparian Vegetation	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.										
BR-A-7.1.1	Recovery Action	Riparian Vegetation	Conserve and manage forestlands for older forest stages.										
BR-A-7.1.1.1	Action Step	Riparian Vegetation	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	20	CDFG, Coastal Ridges, Conservation Fund, Mendocino Redwood Company, Private Landowners, Redwood Forest Foundation, State Parks, The Nature Conservancy						TBD	Cost cannot be estimated because overall amount of landowner participation is unknown (particularly for conservation easements).

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-7.1.1.2	Action Step	Riparian Vegetation	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	60	CalFire, CalTrans, Conservation Fund, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RWQCB, State Parks						TBD	Particular attention should be directed at implementing this action along mainstem Big River. 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.
BR-A-7.1.1.3	Action Step	Riparian Vegetation	Encourage development and implementation of a program similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	60	Conservation Fund, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, Mid Penninsula Open Space District, State Parks, SWRCB	0.00	0.00	0.00	0.00	0.00	0	Adoption of the existing plan should minimize costs. Majority of the cost likely the result of tailoring the document to Mendocino County issues.
BR-A-8.1	Objective	Sediment	Improve habitat conditions at multiple life stages by reducing sediment input to the stream channel network.										
BR-A-8.1.1	Recovery Action	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.										
BR-A-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	1	5	CalFire, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USEPA						TBD	Sediment reduction plan could be part of a larger road and sediment reduction plan. This plan should tier off recommendations in the Big River TMDL.
BR-A-8.1.1.2	Action Step	Sediment	Identify areas at increased risk of mass wasting and elevated fine sediment load, and decrease sediment from transportation projects and land management activities in those areas (DFG 2004).	2	5	CalFire, California Department of Mines and Geology, Conservation Fund, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB						0	Cost is likely minimal because most of these sites have likely already been identified and cataloged by CalFire and Mines and Geology through the THP process.

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino County Department of Public Works, RWQCB, State Parks	50.00	50.00	50.00	50.00	50.00	3,000	This infrastructure is likely present in many of the Big River subwatersheds. Additional sites may be installed as part of the timber harvest plan process and the cost for construction will likely be absorbed on a harvest plan by harvest plan basis. Ongoing maintenance will likely occur as part of yearly evaluation prior to the winter period. Maintenance costs are estimated at $50,000/yr. Most of these costs are not anticipated to be additional costs to landowners but should be viewed as expenses incurred for maintenance of existing infrastructure.
BR-A-9.1	Objective	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.										
BR-A-9.1.1	Recovery Action	Viability	Measure or estimate the condition of key habitat attributes across the watershed. Prioritize Core tributaries first, followed by Phase I and Phase II areas as appropriate.										
BR-A-9.1.1.1	Action Step	Viability	Implement standardized assessment protocols (i.e., DFG habitat assessment protocols) to ensure ESU-wide consistency.	3	60	CalFire, California Department of Mines and Geology, CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Consultants, Private Landowners, RPFs, RWQCB, SWRCB, UC Extension						TBD	Most of the watershed has been habitat typed according to DFG stream protocols. New habitat assessment methods may result in additional (but unknown) costs for Big River.
BR-A-9.1.2	Recovery Action	Viability	Monitor population status for response to recovery actions.										
BR-A-9.1.2.1	Action Step	Viability	Conduct monitoring activities to determine the population status of adult and salmonid smolts in Core and Phase 1 areas.	2	12	CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, State Parks	100	100	100	100	100	1,200	Cost may total on 100k per year for both adult and smolt surveys. However, due to other monitoring efforts in adjacent diversity stratum watersheds - Noyo in particular - monitoring in Big River may be of a lesser intensity. Monitoring in the Big River watershed should be closely coordinated and complementary with other ongoing monitoring efforts in the Lost Coast Diversity Stratum. Cost estimates based on presumed redd survey methods in three key tributaries (rough estimate of necessary sampling intensity).
BR-A-10.1	Objective	Water Quality	Improve summer rearing survival by reducing instream temperatures in potential rearing reaches. Also follow strategies for restoring and enhancing riparian vegetation.										
BR-A-10.1.1	Recovery Action	Water Quality	Encourage riparian restoration and establishment of wider riparian buffers in rural residential and forest management areas.	2	60	CalFire, CDFG, Mendocino County, Mendocino Redwood Company, NOAA RC, NRCS, Private Landowners, RCD						TBD	

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Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-15.1	Objective	Droughts	All Federal, State and local, planning should include considerations and allowances that ensure continued operations during droughts while also providing for CCC coho salmon recovery needs.										
BR-A-15.1.1	Recovery Action	Droughts	Enforce existing, and support development of new, regulations to minimize impacts on summer baseflow from water rights users.										
BR-A-15.1.1.1	Action Step	Droughts	DFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (DFG 2004).	3	10	CDFG, NMFS, Private Landowners						TBD	Cost to landowners may be low due to past over harvesting in riparian zones.
BR-A-15.1.2	Recovery Action	Droughts	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.										
BR-A-15.1.2.1	Action Step	Droughts	Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions in the summer and fall months.	2	10	CDFG, NMFS, SWRCB	10.00	10.00	10.00	10.00	10.00	100	Initial efforts should be focused in upper South Fork Big River where numerous small landowners are believed to divert from Big River for domestic purposes.
BR-A-15.1.2.2	Action Step	Droughts	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.	2	10	CDFG, NMFS, SWRCB						0	
BR-A-15.1.2.3	Action Step	Droughts	If predicted flows are below a level considered critical to maintain habitat conditions for coho salmon, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	2	60	CDFG, NMFS, Private Landowners, SWRCB						TBD	
BR-A-20.1	Objective	Logging and Wood Harvesting	Establish greater oversight for pre and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.										
BR-A-20.1.1	Recovery Action	Logging and Wood Harvesting	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	2	10	CalFire, NMFS						0	Financial estimate is present in the Ten Mile River recovery strategy. It is assumed that this recommendation will require one full time NMFS position dedicated to the Lost Coast Diversity stratum.
BR-A-20.1.2	Recovery Action	Logging and Wood Harvesting	Extend the monitoring period and upgrade THP road maintenance after harvest.	2	60	CalFire, CDFG, Private Landowners, RWQCB						0	
BR-A-20.2	Objective	Logging and Wood Harvesting	Conserve and manage forestlands for older forest stages.										
BR-A-20.2.1	Recovery Action	Logging and Wood Harvesting	Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.	3	10	Board of Forestry, CalFire, CDFG, Mendocino County, NMFS PRD, RWQCB						0	Cost expected to be minimal if current agency staff can conduct work to improve regulations.
BR-A-20.2.2	Recovery Action	Logging and Wood Harvesting	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	20	CDFG, Mendocino County, NMFS						0	Cost expected to be minimal if current agency staff can work with County of Mendocino.
BR-A-20.2.3	Recovery Action	Logging and Wood Harvesting	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	60	CDFG, Mendocino County, NMFS, RWQCB						0	Minimal cost if conducted with agency staff.
BR-A-20.2.4	Recovery Action	Logging and Wood Harvesting	Manage riparian areas for their site potential composition and structure.	2	60	CalFire, Mendocino Redwood Company, Private Landowners						TBD	Some cost to timber landowners. Need additional cost analysis for estimate to implement this management. Cost difficult to estimate and will depend on harvest strategies of the various landowners in the watershed.

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							FY1	FY2	FY3	FY4	FY5	Entire Duration	
BR-A-20.2.4.1	Action Step	Logging and Wood Harvesting	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CalFire, CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino Redwood Company, NRCS, Private Landowners, RWQCB, State Parks	5.00	5.00	5.00	5.00	5.00	100	Costs are difficult to predict because a significant proportion of the watershed is under active timber management. In those areas where timber management is not ongoing (State Parks) additional costs will be incurred in order to implement this recommendation. Conifer release should only occur in those areas where adverse affects to instream temperature are anticipated to be minimal.
BR-A-20.3	Objective	Logging and Wood Harvesting	Provide for properly functioning watershed processes (e.g., cycles of wood, water and sediment) by promoting long term sustainable forestry practices that support coho salmon habitats.										
BR-A-20.3.1	Recovery Action	Logging and Wood Harvesting	Require tree retention on the axis of headwall swales Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	60	Board of Forestry, CalFire, CDFG, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB						0	
BR-A-20.4	Objective	Logging and Wood Harvesting	Encourage a watershed-wide HCP for all or multiple landowners within a watershed to pool resources as a means to facilitate long-term survival and recovery for coho salmon and their habitat.	3	30	CalTrans, CDFG, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, NMFS, Private Landowners, State Parks, USFWS	33.33	33.33	33.33	33.33	33.33	1,000	Cost is a rough estimate and may vary considerably depending on the number of species and activities covered. A multiple landowner HCP is preferable due to economy of scale and overall, similar land management actions across the watershed. Although MRC is developing its own HCP for its lands in the Big River watershed, other landowners may be able to leverage off this effort as a means of reducing development cost.
BR-A-24.1	Objective	Roads and Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources in Core CCC coho salmon areas within five years, Phase I within 10 years, and Phase II areas within 15 years (from 2010).										
BR-A-24.1.1	Recovery Action	Roads and Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
BR-A-24.1.1.1	Action Step	Roads and Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, California Department of Mines and Geology, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	15.00	15.00	15.00	15.00	15.00	150	This plan should leverage the Big River TMDL. If most of the TMDL recommendations are adopted the total cost of this plan would likely be significantly less than that estimated here.
BR-A-24.1.2	Recovery Action	Roads and Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized users to decrease fine sediment loads.										

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

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BR-A-24.1.2.1	Action Step	Roads and Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	60	CalFire, CalTrans, Conservation Fund, Jackson Demonstration State Forest, Mendocino County Department of Public Works, Mendocino Redwood Company, NRCS, Private Landowners, RWQCB, State Parks						0	The recommendation should be considered a part of ongoing road maintenance and should occur for the entire road network for each respective land owner in the watershed.
BR-A-24.1.3	Recovery Action	Roads and Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).										
BR-A-24.1.3.1	Action Step	Roads and Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	60	CalFire, CalTrans, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino County Department of Public Works, RWQCB, State Parks						0	These areas are likely already established in the watershed. Efforts should be made to coordinate storage with all landowners in the basin to minimize cost and impacts to water quality.
BR-A-24.1.3.2	Action Step	Roads and Railroads	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.	1	60	CalFire, CalTrans, Conservation Fund, Jackson Demonstration State Forest, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RPFs, State Parks						0	Many roads in the watershed have inside ditches. Cost should be considered part of ongoing road maintenance costs.
BR-A-24.2	Objective	Roads and 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.										
BR-A-24.2.1	Recovery Action	Roads and Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (DFG 2004).	1	5	CalFire, California Department of Mines and Geology, Conservation Fund, Jackson Demonstration State Forest, Mendocino County Department of Public Works, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners, RCD, State Parks	80.00	80.00	80.00	80.00	80.00	400	Implementation of this recommendation may be more achievable in the Big River watershed than most other watersheds in the ESU due to the large percentage of private and public ownership. Recent purchase of the lower Big River watershed by State Parks could result in significant opportunities to decommission problematic riparian roads.

Big River (Lost Coast-Navarro Point) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
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BR-A-24.2.2	Recovery Action	Roads and Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	5	Board of Forestry, CalFire, CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, NMFS, Private Landowners, State Parks, SWRCB						TBD	Cost may be low due to extensive road system already present in this watershed.
BR-A-24.3	Objective	Roads and Railroads	Identify and remove existing passage barriers.										
BR-A-24.3.1	Recovery Action	Roads and Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	5	California Coastal Conservancy, CDFG, NOAA RC, NRCS, Private Landowners, RCD	10.00	10.00	10.00	10.00	10.00	50	Barriers on public roads and industrial timberlands are generally already known. Focus of this recommendation should be directed towards small private landowner roads.
BR-A-24.3.2	Recovery Action	Roads and Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	60	CalFire, CalTrans, CDFG, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County Department of Public Works, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, State Parks, USACE						TBD	Additional cost of meeting NMFS guidelines is will vary by project. However, these guidelines are standard requirements that are applied by most landowners and regulatory agencies working in the watershed.
BR-A-25.1	Objective	Storms and Flooding	Conduct outreach and education regarding how local, city, county, State and Federal planning can put in place mechanisms that provide community resiliency to storms and flooding.										
BR-A-25.1.1	Recovery Action	Storms and Flooding	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).	3	60	Mendocino County, Private Landowners						TBD	Some additional cost to the County and private landowners.
BR-A-25.1.2	Recovery Action	Storms and Flooding	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.	3	60	CDFG, NMFS						TBD	Cost should be one time for ESU wide use.
BR-A-25.2	Objective	Storms and Flooding	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	20	CalFire, California Department of Mines and Geology, CDFG, Jackson Demonstration State Forest, NOAA RC, Private Landowners						TBD	Number and site specific information needed to develop cost estimate.