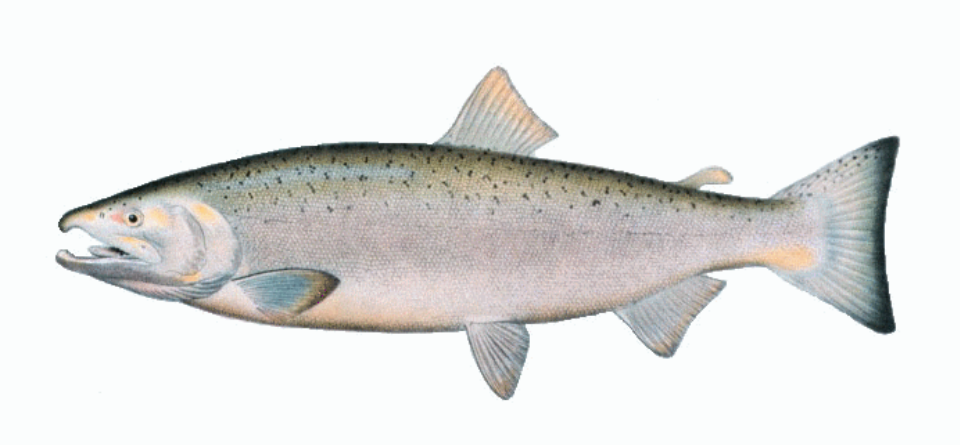
Magnuson-Stevens Reauthorization Act
Klamath River Coho Salmon Recovery Plan



Prepared by
The National Marine Fisheries Service
Southwest Region

July 10, 2007

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NATIONAL MARINE FISHERIES SERVICE

NOAA's National Marine Fisheries Service (NMFS), a division of the Department of Commerce, is the federal agency responsible for the stewardship of the nation's living marine resources and their habitat. NMFS is responsible for the management, conservation and protection of living marine resources within the United States' Exclusive Economic Zone (coastal water 3 to 200 miles offshore). Using the tools provided by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA), NMFS assesses and predicts the status of fish stocks, ensures compliance with federal fisheries regulations and works to reduce wasteful fishing practices. Under the Marine Mammal Protection Act and the Endangered Species Act (ESA), NMFS works to conserve protected marine species (*i.e.,* whales, turtles) and protected anadromous species (*i.e*., salmon) without unnecessarily impeding economic opportunities.

NMFS is responsible for completing the "Magnuson-Stevens Reauthorization Act Klamath River Coho Salmon Recovery Plan" under 2007 amendments included in the MSRA. These new amendments also require NMFS to submit within 2 years of enactment, and annually thereafter, a report to Congress on: (1) actions taken under the Magnuson-Stevens Reauthorization Act Klamath River Coho Salmon Recovery Plan and other laws relating to the recovery of Klamath River coho salmon and how those actions are contributing to its recovery; (2) progress made on restoration of salmon spawning habitat, including water conditions as they relate to salmon health and recovery, with an emphasis on the Klamath River and its tributaries below Iron Gate Dam; (3) the status of other Klamath River anadromous fish populations, particularly Chinook salmon; and (4) the actions taken by NMFS to address the 2003 National Research Council recommendations regarding monitoring and research on Klamath River Basin salmon stocks.

Working closely with the Pacific Fishery Management Council (PFMC), NMFS is the lead federal agency responsible for managing a sustainable west coast salmon fishery, which includes approving, implementing and enforcing the salmon fishery management plan, associated amendments, and annual regulations, and conducting Essential Fish Habitat consultations under the MSRA. Chinook salmon populations from the Klamath River play a key role in the West Coast salmon fishery. NMFS' Southwest and Northwest Fisheries Science Centers (SWFSC and NWFSC, respectively) support the NMFS Regional Offices and PFMC process by providing salmon harvest management guidance through modeling and focused biological studies.

NMFS is the lead federal agency in the Klamath River Basin for protecting and recovering the threatened coho salmon under the ESA, including: listing determinations, development of federal recovery plans, consultations with federal action agencies, and habitat conservation planning with private landowners. NMFS listed the Southern Oregon/Northern California Coast (SONCC) coho salmon Evolutionarily Significant Unit (ESU), which includes all naturally spawning populations of coho salmon between Cape Blanco, Oregon, and Punta Gorda, California, as a threatened species under the ESA in 1997 and 2005. NMFS Southwest Region initiated ESA recovery planning for SONCC coho salmon in 2002 and is currently preparing additional key components of the plan. NMFS works with federal action agencies conducting activities in the Klamath River Basin, completing hundreds of ESA section 7 consultations, and NMFS is involved in other ESA-related activites, such as providing technical assistance in the development of habitat conservation plans, evaluating hatchery practices, and coordinating on

implementation of improved irrigation practices and water use in important Klamath River Basin tributaries.

Under the Federal Power Act, NMFS developed mandatory prescriptions for the Federal Energy Regulatory Commission's re-licensing of the PacifiCorps' hydroelectric project on the Klamath River and provided significant analytic support related to fish passage and dam decommissioning throughout the process. NMFS is a party in the settlement discussions associated with this relicensing effort and expects to play an important role in the implementation of any settlement agreements.

In collaboration with a diversity of public, private and non-profit partners, NMFS's Southwest Region works to conserve and protect salmon and steelhead in the Klamath River Basin while affording economic opportunities for local communities. NMFS' Southwest Region is engaged in a variety of additional collaborative conservation activities throughout the Klamath River Basin, including support to numerous councils and organizations associated with monitoring, research and restoration activities. Since 2000, NMFS' Southwest Region has issued over $13.9 million (M) to California and $6.2 M to Klamath River Basin indian tribes for salmon restoration projects within the Klamath River Basin.

PREFACE

Only a century ago, the people of the Klamath River Basin enjoyed the riches and benefits of a healthy and diverse ecosystem,which supported the third largest salmon population in the continental United States. The Klamath River and its tributaries provided essential subsistence and cultural values to native American indian tribes as well as opportunities for robust commercial and recreational fisheries. For generations, rural agricultural and timber communties within the Klamath River Basin relied on the availablity of water and land resources for economic sustainablity. Today these uses are in serious conflict as salmon runs decline and fishing, timber, and agricultural interests compete for limited supplies of water. The restoration of the Klamath River ecosystem deserves conscientious stewardship while respecting the diversity of interests of affected Basin communities.

No one public entity has the singular authority, or sufficient funding, to restore Klamath fisheries on its own. Today, over a dozen federal and state agencies are working to conserve and manage natural resources while maintaining economic opportunities in the Klamath River Basin. Indian tribes have unique and recognized rights and interests, self-governance authorities, as well as active conservation programs in the Klamath River Basin. Nine county jurisdictions (five in California and four in Oregon) occur in the Klamath River Basin, representing additional authorities for regulating local programs on county lands. Private landowers play an important role in collaborative efforts to develop and implement restoration actions and sustainable land- and water-use practices. Finally, conservation organizations and watershed groups work to provide outreach, advocacy, and can serve as facilitators of restoration actions. Lasting resolution of the Klamath River Basin's complex natural resource problems will require integrated, comprehensive solutions that rely on effective partnerships among the Basin's diverse communities and interests.

Conflicts over water use in the Klamath River Basin have existed for decades, pitting conservationists, tribes, farmers, fishermen and local, state and federal agencies against each other. Recently, settlement discussions associated with Federal Energy Regulatory Commission's relicensing of PacifiCorps' hydroelectric Project have brought these diverse interests together for the first time in an effort to develop a comprehensive and lasting solution. While seeking to understand each others' interests and working towards mutually-agreeable durable solutions to address these interests, parties to the settlement discussions are defining a comprehensive solution that is centered on the restoration of fisheries and sustainabilty of affected communities in the Klamath River Basin consistent with environmental laws.

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I. INTRODUCTION

Coho salmon (*Oncorhynchus kisutch*) have experienced a significant decline in abundance over the past century along the west coast of North America. Their reliance on coastal streams and off-channel wintering habitats has made coho salmon vulnerable to the effects of poor water quality conditions and barriers to fish passage from coastal development and land-use, including dams. Since the 1960s, coho salmon abundance has declined at least 70 percent in California (Weitkamp *et al.* 1995). In the Klamath River, little information exists on the historical abundance of coho salmon. Data associated with canneries of the early 1900s indicate hundreds of thousands of adult coho salmon returned to the Klamath River annually (Weitkamp *et al.* 1995). Monitoring data suggest a marked decline in abundance of adult coho salmon returning to the Klamath River to spawn by the 1950s. By the early 1980s, the annual escapement of adult coho salmon to the Klamath River ranged from an estimated 15,000 to 20,000 fish, including hatchery fish.

In 1995, NOAA's National Marine Fisheries Service (NMFS) determined that the Southern Oregon/Northern California Coast (SONCC) coho salmon Evolutionary Significant Unit (ESU), composed of populations inhabiting coastal streams between Punta Gorda, California and Cape Blanco, Oregon, and including coho salmon that inhabit the Klamath River, constitutes a "distinct population segment" under the Endangered Species Act (ESA). Although in the 1940s SONCC coho salmon populations ranged from 150,000 to 400,000 naturally spawning fish, by the late 1990s NMFS found that SONCC coho salmon populations were "greatly diminished and … composed largely of hatchery fish," with only approximately 10,000 naturally-spawning coho salmon in the California portion of the SONCC ESU (Weitkamp *et al.* 1995). In 1997, NMFS listed the SONCC coho salmon ESU as a threatened species under the ESA due to a variety of factors, including habitat degradation, harvest, artificial propagation, drought, floods, and poor ocean conditions (Weitkamp *et al.* 1995). NMFS also concluded that existing regulatory mechanisms across the ESU were inadequate and existing conservation efforts were insufficient to conserve SONCC coho salmon. NMFS re-evaluated the status of coho salmon in 2001 and determined that it should remain a threatened species under the ESA. In 2005, the California Fish and Game Commission found that coho salmon warranted listing as a threatened species from Punta Gorda, California north to the California-Oregon border under the California Endangered Species Act (CESA). In Oregon, under Oregon's Native Fish Conservation Policy adopted in 2002 and revised in 2003 (Oregon Department of Fish and Wildlife (ODFW) 2005), ODFW considers the status of salmon populations in Oregon that overlap with the SONCC ESU as either "critical," or, in the case of the upper Klamath River watershed, a "no status" rating is given since coho salmon have been excluded from the upper basin since the construction of impassible dams in the mainstem Klamath River.

On January 12, 2007, President Bush signed into law the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA). The updated MSRA includes several new requirements related to salmon in the Klamath River Basin. In particular, within six months after the enactment of the MSRA, NMFS must complete a recovery plan for Klamath River coho salmon and make it available to the public. Given the statutory deadline, NMFS relied on the foundation of data currently in existence for Klamath River Basin coho salmon to complete this recovery plan.

NMFS has compiled and synthesized the best available information on coho salmon in the Klamath River in a cohesive framework to develop the Magnuson-Stevens Reauthorization Act Klamath River Coho Salmon Recovery Plan (MSRA Recovery Plan). NMFS has primarily relied on published information in this synthesis. The MSRA Recovery Plan draws heavily from existing recovery and restoration plans developed with substantial stakeholder participation (*e.g.*, Northwest Forest Plan (NFP), U.S. Department of Agriculture – Forest Service (USFS) and U.S. Department of Interior – Bureau of Land Management (BLM) 1994; Klamath River Basin Fishery Resources Restoration Act of 1986; and the California Department of Fish and Game (CDFG) Recovery Strategy for California Coho Salmon (CDFG 2004)), as well as various sub-basin restoration and management plans.

The MSRA Recovery Plan presents long-range guidance for various agencies, organizations and individuals to use as they consider taking actions or pursuing projects that may affect Klamath River coho salmon.

II. OVERVIEW OF THE KLAMATH RIVER BASIN

A. Geographic Setting of the Basin

The Klamath River Basin encompasses over 10 million acres of south-central Oregon and north-central California (Figure 1). Today, the region includes about 96,000 acres of tribal trust lands, four million acres of private lands, and six million acres of public lands. The Klamath River Basin includes six National Wildlife Refuges (Bear Valley, Clear Lake, Klamath Marsh, Lower Klamath, Tule Lake, and Upper Klamath), a National Park (Crater Lake), five National Forests (Fremont-Winema, Klamath, Shasta-Trinity, Modoc, and Six Rivers), two National Monuments (Lava Beds and Cascade Siskiyou), three Wild and Scenic River designations (Klamath River from J.C. Boyle Powerhouse to the California-Oregon border, North Fork Sprague River, and the Sycan River), and other public lands. The basin also includes four federally-recognized tribes, including the Yurok Tribe (lower Klamath River), the Hoopa Tribe (lower Trinity River), the Karuk Tribe of the middle Klamath, and several tribes located in the Upper Klamath River Basin in Oregon (collectively referred to as the Klamath Tribes).

The Klamath River originates in south-central Oregon, east of the Cascade Mountain range, and flows 263 miles, generally in a southwesterly direction, through southern Oregon and northern California, bisecting the Cascade and Coast ranges. The Wood, Williamson, Sprague and Sycan Rivers are the significant headwater tributaries that flow into Upper Klamath Lake. Water flows from Upper Klamath Lake into the short Link River (about 1.2 miles long), and then into Lake Ewauna near Klamath Falls, Oregon. The Klamath River officially begins at the downstream end of Lake Ewauna. Iron Gate Dam, at river mile (rm) 190, is a commonly recognized dividing

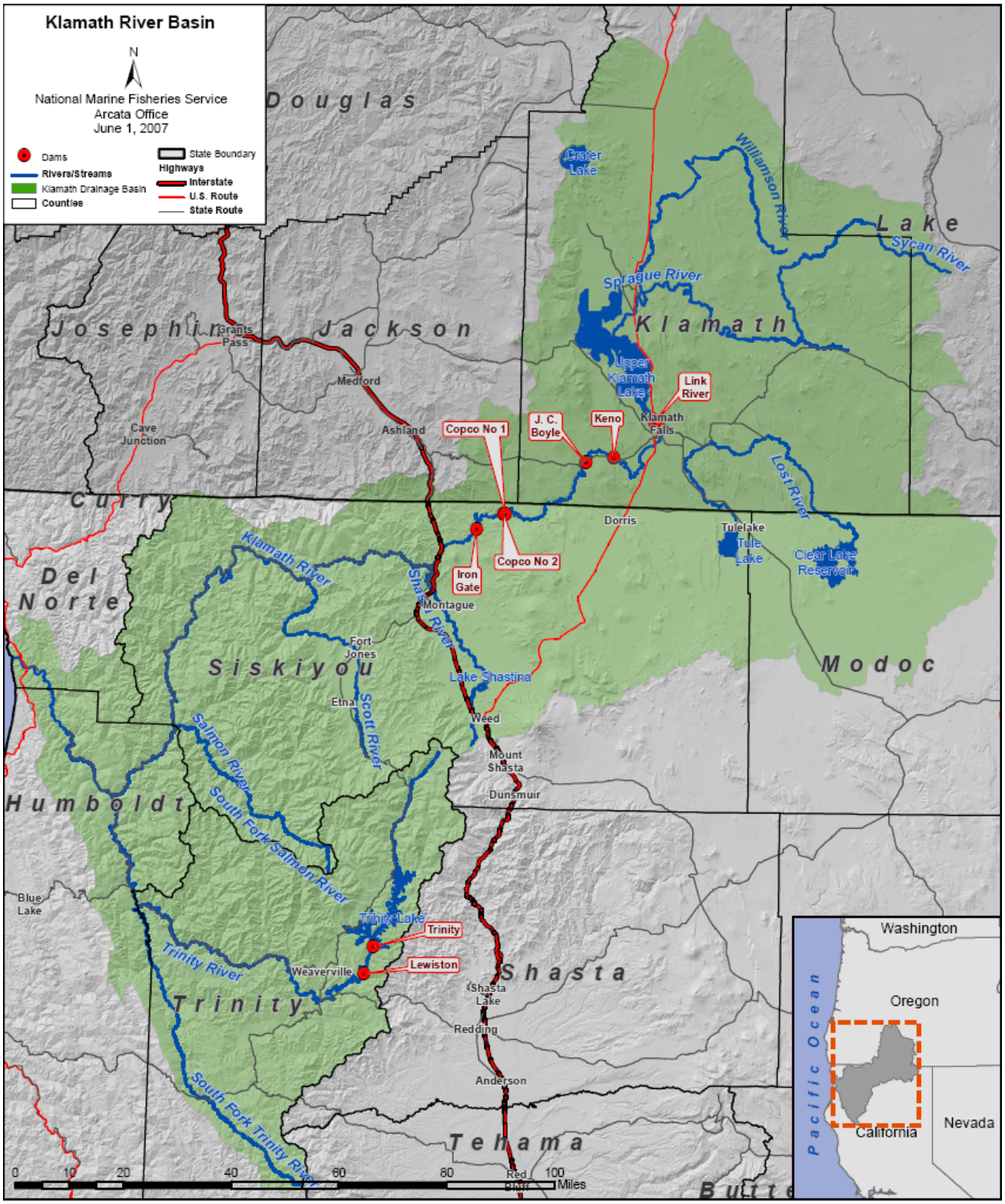


Figure 1: Map of the Klamath River Basin, Northern California and Southern Oregon.

point between what is referred to as the upper and lower river basins. Major tributaries of the lower Klamath River are the Shasta, Scott, Salmon, and Trinity Rivers. The Klamath River enters the Pacific Ocean about 22 miles south of the California-Oregon border.

III. KLAMATH RIVER BASIN COHO SALMON LIFE HISTORY

A. Adult Coho Salmon Freshwater Entry to Spawning

In larger river systems like the Klamath River, coho salmon have a broad period of freshwater entry (Leidy and Leidy 1984). Overall, earlier migrating fish spawn farther upstream within a basin than later migrating fish, which enter rivers in a more advanced state of sexual maturity (Sandercock 1991). Adult coho salmon migrate at water temperatures of 45 to 59ºF, a minimum water depth of approximately 7 inches, and streamflow velocities less than 8 ft/s (Bjornn and Reiser 1991). Coho salmon are known to stage at the confluences of tributaries, holding until flows and temperatures are suitable for migration into upper tributary spawning habitat.

Adult coho salmon return to the lowermost Klamath River as early as the first week of September, and the peak of migration passes through the Klamath estuary in early October (U.S. Bureau of Reclamation (Reclamation) 2007). Further upstream, adult immigration into the Klamath River basin and its tributaries begins in mid-October through mid-December, with peak immigration in mid-November through early December (Weitkamp *et al.* 1995). While coho salmon are primarily tributary spawners, they do occasionally spawn in the mainstem Klamath River. Spawning coho salmon were observed using side channels of the Klamath River near Seiad Valley in November and December of 1993 (U.S. Fish and Wildlife Service (USFWS) 1998).

B. Coho Salmon Eggs to Emergence

The length of time required for eggs to incubate in the gravel is largely dependent on water temperature. The favorable range for coho salmon egg incubation is 10-13.5ºC (Bell 1991). Eggs typically hatch at approximately 35 to 50 days, and start emerging from the gravel 2 to 3 weeks after hatching (Hassler 1987, Nickelson et al. 1992).

C. Coho Salmon Young-of-Year to Smolts

Coho salmon fry emerge from the gravel and congregate in shallow, low velocity portions of the stream margin. Juvenile coho salmon (i.e., fish post-emergence and prior to ocean arrival) are often futher differentiated as either young-of-year (YOY), that is, fish less than one year old, parr (stage between emergence and smolt, exhibiting dark “parr” marks on its sides), and smolt (seaward migrant stage), depending on age and body characteristics during their typical 1.5 year freshwater residency. As their swimming capabilities improve, coho salmon YOY seek out portions of the stream channel that provide cover elements and suitable hydraulic parameters that allow them to feed and rear efficiently. Flooded riparian vegetation and oxbow channels associated with beaver ponds are critical to both winter and summer survival of juvenile coho salmon (CDFG 2004, Weitkamp *et al.* 1995). As coho salmon YOY grow larger, they disperse

upstream and downstream, establishing and defending their territory from other salmonids (Hassler 1987).

Although the Klamath River mainstem lacks much of the classic rearing habitat described above, YOY coho salmon are frequently found in the mainstem Klamath River from March through June. As irrigation depletions within tributaries begin to limit available habitat, especially in dryer years, coho salmon YOY rearing habitat in the mainstem Klamath River may become increasingly important. Small numbers of YOY coho salmon were captured in the mainstem Klamath River at Big Bar (1992-1995), below the Scott River (1994), and at Presido Bar (1994) beginning in early April, peaking in May, and diminishing in late July (USFWS 1998). Recent thermal refugial studies on the mainstem Klamath River have documented the persistence of small numbers of coho salmon YOY near select tributary confluence habitat throughout the summer period (Sutton *et al.* 2004; Soto 2007). The National Research Council Committee on Endangered and Threatened Fishes in the Kamath Basin (NRC) addressed the importance of mainstem Klamath River habitat to listed coho salmon in its review of NMFS' 2002 Biological Opinion regarding the effects of Klamath Project Operations on listed coho salmon (NRC 2002). The NRC did not find evidence that the mainstem Klamath River is a significant rearing area for coho salmon and concluded it seemed unlikely "that the coho is saturating its available mainstem habitat." Although the importance of tributary rearing habitats to coho salmon YOY survival is widely recognized and restoring degraded tributary habitat within the Klamath River Basin will likely be paramount to recovering the species (NRC 2002), mainstem habitat may nevertheless play a critical role in YOY coho salmon survival in rivers such as the Klamath where tributary conditions are particularly inhospitable.

To survive periods of elevated water temperature, YOY and parr coho salmon likely cope via refugial habitats and behavioral adaptations. When water temperatures exceed the preferred range, juvenile salmonids likely seek out mainstem areas of cold groundwater seepage or tributary inflow that provide small areas of thermal refugia (NRC 2002). Furthermore, NRC (2002) concluded that where diurnal fluctuations in water temperature are large, fish may experience adequate foraging opportunities while opportunistically exploiting favorable nighttime water temperatures.

During summer months, YOY coho salmon prefer habitat characteristics observed in small streams (*i.e.*, pools and riffles featuring adequate cover, such as large woody debris (LWD), undercut banks, and overhanging vegetation), as opposed to habitat features generally found in the mainstem Klamath River. Water velocity and the presence of other fish can be important constraints on habitat usage, since young coho salmon often must remain in shallow fringe habitat within larger pools until they become large enough to secure more favorable habitat in deeper, faster water (Meehan and Bjornn 1991). Young coho salmon feed mainly on aquatic and terrestrial insects (Mundie 1969 op. cit. Meehan and Bjornn 1991).

At the onset of fall, parr coho salmon may move considerable distances in response to fall freshets (Scarlett and Cederholm 1984). Parr coho salmon will seek out winter habitat that contains refuge from high water velocities, utilizing off channel habitats and habitats containing cover complexity (Narver 1978, Cederholm and Scarlett 1981). Juvenile coho salmon may continue to move throughout the fall/winter period, utilizing a diversity of complex habitat

characteristics to protect them from potential survival risks (*e.g.*, high steam flows, predators). As juvenile coho salmon approach the migratory smolt stage, the parr marks become less evident and the overall color of the fish lightens and becomes more silvery.

D. Coho Salmon Smolts

Coho salmon smolts typically migrate to the sea between March and June (Weitkamp *et al.* 1995), but some level of emigration may occur throughout the year. Taking advantage of cooler ambient temperatures and the afforded protection from predators, the bulk of seaward migration occurs at night. Peak outmigration generally occurs in May, about a year after the fry emerge from the gravel. Little is known about residence time or habitat use in estuaries during seaward migration. Nickelson *et al.* (1992) assumed that coho salmon spend only a short time in the estuary before entering the ocean. Growth is very rapid once the smolts reach the estuary (Fisher *et al.* 1984).

Fish that have spent a year or more in streams and are about to undergo the physiological changes associated with smoltification begin by defending their territories less vigorously and forming aggregations. Once groups have formed, coho salmon of similar size begin to emigrate from tributaries, migrating toward the ocean (Hoar 1951, Shapovalov and Taft 1954). In the mainstem Klamath River, coho salmon smolts have been captured from mid-March through early August (USFWS 1998).

IV. KLAMATH RIVER BASIN COHO SALMON ABUNDANCE

This section first provides a general overview on the abundance of coho salmon in the Klamath River Basin, and ends with a discussion investigating the impact of changing ocean conditions on coho salmon abundance. Little information exists to provide insight on the historical abundance of coho salmon. Historic records for coho salmon abundance are scarce prior to 1910, due in part to the inability of people to accurately identify salmon, non-specific nomenclature to refer to different species or run-timing, and the subsequent inclusion of all salmon into one category of commercial Chinook salmon catch (CDFG 2002, Hamilton *et al.* 2005, Snyder 1931). Snyder (1931) reported the first commercial gill net catch of 11,162 coho salmon in the lower reaches of the Klamath River, in 1919. He was also the first author to report a concern for declining salmon populations in California, due to commercial fishing, forestry and agricultural practices. Long-term monitoring data (*e.g.*, Shasta River racks) suggest a marked decrease in abundance of adult coho salmon by the 1950s, resulting from over-harvest and habitat loss (CDFG 2004, Weitkamp *et al.* 1995, Klamath River Basin Fisheries Task Force 1991). By 1983, the annual escapement abundance of Klamath River Basin adult coho salmon was estimated to range from 15,000 to 20,000 fish (Leidy and Leidy 1984). These estimates, which include hatchery stocks, could be less than six percent of their abundance in the 1940s (CDFG 2004, Weitkamp *et al.* 1995). In 1995, leading up to the listing of SONCC coho salmon as threatened under the ESA, NMFS concluded that the Klamath populations of coho salmon were diminished from historical abundances and were comprised mostly of hatchery fish (Weitkamp *et al.* 1995), suggesting that available habitat is not sustaining wild populations necessary for healthy salmon stocks.

Monitoring studies have employed a number of techniques to collect abundance, distribution and run timing data on juvenile and adult salmonids. In general, Klamath River Basin salmon monitoring studies have primarily been funded to collect abundance information on fall run Chinook salmon because of their role in managing the ocean fishery. While these studies provide us with some information specific to coho salmon, data are largely incomplete, leading the NRC (NAS 2004) to recommend the development of a comprehensive coho salmon monitoring plan. NMFS' Southwest Region and Southwest Fisheries Science Center (SWFSC) are currently working with CDFG in developing a California coastal anadromous salmonid monitoring plan. The plan will describe the monitoring necessary for gathering data and information concerning coho salmon population abundance, diversity, productivity, and spatial structure within the Klamath River Basin and its tributaries.

A. Adult Coho Salmon Abundance

Monitoring efforts providing information on the abundance of Klamath River adult coho salmon indicate that their abundance is depressed, but stable. In the Shasta and Scott Rivers, where population-specific data are most detailed and runs are primarily composed of wild stocks, data suggest the 2004 adult returning brood year class appears to be the strongest in recent years, while the 2005 and 2006 brood year class abundances are extremely depressed (Table 1).

Table 1. Klamath River Basin adult coho salmon abundance information, 2002-2006.

Year	Yurok Tribal Harvest[a]	Trinity River Weir[b]	Scott River Live Fish or Redd Counts[a]	Shasta River Video Weir[a]	Bogus Creek Fish Counting Facility[a]	Iron Gate Hatchery Returns
2002	486	14,307	17[c]	86	n/a	1,193
2003	343	25,651	8[c]	187	n/a	1,317
2004	1,540	35,209	1,577[c]	373	414	1,495
2005	n/a	28,267	23[d]	69	114	1,384
2006		20,162	7[d]	45	35	332

a Annual effort not consistent between years (Yurok Tribal Fisheries Department).
b Estimated escapement abundance extrapolated from weir observations (CDFG).
c Live fish counts
d Redd counts.

From 2003 through 2005, USFWS extended its mainstem Klamath River adult salmon surveys into December, as conditions allowed, to better observe the abundance and distribution of coho salmon spawners. There are logistical problems, however, that confound the ability to identify coho salmon redds (nests dug in the gravel for egg deposition) in both mainstem and tributary reaches. For example, turbid high-flow conditions during November and December can impede the ability to observe redds, affecting the results of monitoring studies. In addition, for the crew to be sure that observed redds were constructed by coho salmon and not some other species of salmon, a positive identification of adult coho salmon on or near the redd site is required. These

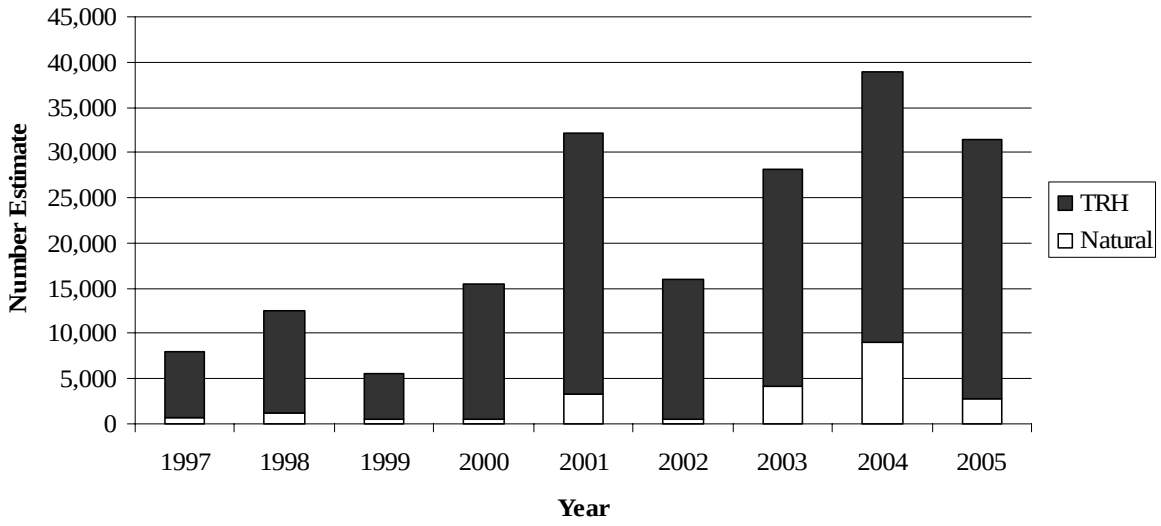
logistical challenges, combined with the sparse number of coho salmon spawning in the mainstem, have resulted in low numbers of adult coho salmon redds observed in the Iron Gate Dam to Indian Creek reach of the mainstem Klamath River (Table 2). These documented cases of mainstem coho salmon spawning indicate that the proportion of mainstem spawners may be a relatively small percentage of the annual adult coho salmon spawning population. For example, attempts at conducting Scott River redd surveys have experienced similar logistical problems, resulting in varying levels of annual effort. Data collected since 2001, however, indicate that coho salmon spawning is relatively more abundant in the Scott River drainage than in the mainstem Klamath River.

Table 2. Mainstem Klamath River coho salmon redds observed during fall/winter surveys (USFWS 2007) from Iron Gate Dam to Indian Creek.

Year	Number of Redds
2001	21
2002	6
2003	7
2004	6
2005	6

Since 1978, CDFG has operated sampling weirs for adult salmon within the mainstem Trinity River near Willow Creek and Douglas City, California. Between 1978 and 1995, in-river escapement of Trinity River coho salmon (jacks and adults) above Willow Creek has averaged 10,192 fish, ranging from 58 to 32,373 (USFWS/HVT 1999). Data from 1997 through 2005 indicate coho salmon runs have generally been higher than average during recent years, although wild fish continue to represent a very small portion of the overall run (Figure 2). On average, over 90 percent of coho salmon spawning between Willow Creek and Lewiston Dam are of hatchery origin (USFWS/Hoopa Valley Tribe (HVT) 1999).

Figure 2: Estimated Coho Run-size Upstream of Willow Creek Weir, Trinity River (1997 – 2005). Figure from Sinnen *et al.* (2007).



B. Juvenile Coho Salmon Abundance

Annual monitoring data on juvenile coho salmon (*i.e.,* YOY through smolt life history phases), are collected at numerous sites throughout the Klamath River Basin. Key locations include the Shasta and Scott Rivers, and the mainstem Klamath River rotary screw trap located near Orleans (Big Bar rotary screw trap). Similar to the paucity of information on adult coho salmon in the Klamath River Basin, juvenile coho salmon data are limited. Generally, juvenile data are more useful as an indicator of general trends in abundance and run timing, rather than as an estimator of population size. Methods employed to monitor juvenile coho salmon include the use of rotary screw traps and frame nets. USFWS (2007) found frame nets were a more efficient method of capturing YOY coho salmon and provide some insight on habitat use and life history strategies. For example, Stutzer *et al.* (2006) concluded from their spring trapping study that YOY coho salmon were not consistently migrating through the mainstem Klamath River, but instead were holding and rearing for undetermined periods of time as well as moving downstream.

Reports on Klamath River juvenile coho salmon outmigration indicate the abundance of outmigrating YOY and smolt coho salmon is correlated to the abundance of their parent brood year class (*e.g.,* CDFG 2007).

As a result of its annual Shasta River downstream migrant trapping study, CDFG observed a relationship between reduced base flows, increasing water temperatures, and early outmigration of YOY coho salmon (CDFG 2003). In years when spring base flows were reduced early as a result of drought conditions and the onset of agricultural water deliveries, young-of-year coho salmon outmigration to the mainstem Klamath River occurred earlier than in years when Shasta River base flows were sustained at a higher level through the spring (CDFG 2003).

Similar to the mainstem Klamath River drainage, data on juvenile coho salmon abundance in the Trinity basin are lacking. However, juvenile coho salmon are incidentally caught during Chinook salmon outmigration trapping performed by the HVT and USFWS (HVT 2006). During the 2006 spring trapping season, a total of 1,444 juvenile SONCC coho salmon were captured at the Pear Tree rotary screw trap, of which 1,037 (approximately 72 percent of the total-season take) were wild fish (*i.e.*, hatched and reared in a natural stream environment, versus produced within a hatchery setting). The majority of these fish were captured between early May and late June, although small numbers of fish were sporadically captured throughout the summer.

C. Summary of Coho Salmon Abundance Information

Although information on coho salmon population trends in the Klamath River Basin remains incomplete, the information presented above suggests that coho salmon abundance remains depressed. One coho salmon brood year class (*i.e.*, 2004 returning adults) is considerably stronger than the other two brood year classes. Using an adult-to-smolt relationship, CDFG (2007) projects very low abundances of adult coho salmon returning to the Shasta River Basin in 2007 (54 adults) and 2008 (37 adults). The data also indicate that juvenile coho salmon have a strong tendency to redistribute within the basin due to seasonal changes in conditions.

D. Influence of Ocean Conditions on Coho Salmon Abundance

Ocean conditions unfavorable for coho salmon survival are believed to be partly responsible for the depressed status of naturally produced coho salmon stocks in California. Peterson *et al.* (2006) provide evidence that growth and survival rates of salmon in the California current off the Pacific Northwest can be linked to fluctuations in ocean conditions. An evaluation of conditions in the California Current since the late 1970s reveals a generally warm, unproductive regime that persisted until the late 1990s. This regime has been followed by a period of high variability that began with colder, more productive conditions lasting from 1999 to 2002. This brief cold cycle was immediately succeeded by a 4-year period of predominantly warm ocean conditions beginning in late 2002 (Peterson *et al*. 2006). When marine survival rates for coho salmon are plotted against these ocean regime shifts, there is an obvious pattern with higher adult hatchery coho returns being associated with cold water conditions and poor returns occurring during warm water phases. Predictably, the recent warm phase that began in 2002 has corresponded with low numbers of returning adult coho salmon[1]. Evidence suggests these regime shifts follow a more or less linear pattern beginning with the amount and timing of nutrients provided by upwelling and passing "up" the food chain from plankton to forage fish, and eventually, salmon. Moreover, the report indicates these same regime shifts affect the migration patterns of larger animals that prey on salmon (*e.g.*, Pacific hake, sea birds) resulting in a "top-down" effect as well (Peterson *et al*. 2006). On a more local scale, data from the Rogue River show a general correlation between the number of naturally spawning coho salmon and the survival rates for

[1] Although the Peterson *et al*. (2006) study relates primarily to coho salmon off the coasts of Oregon and Washington, it is reasonable to expect the general conclusions relating survival rates and changes in ocean regimes to apply to coho salmon in the Klamath River Basin as well since they are also distributed in the CA Current.

hatchery coho salmon[2], indicating ocean conditions influence trends in coho populations (Good *et al*. 2005). Furthermore, when discussing the potential extinctions of salmon populations, including California stocks, Francis and Mantua (2003) point out that climate patterns would not likely be the sole cause but could certainly increase the risk of extinction when combined with other factors. They further conclude that long-term fluctuations in the marine environment, such as those associated with the Pacific Decadal Oscillation (PDO), as opposed to annual variability, appear to have a greater impact on coho salmon. However, effects from alterations in the marine environment can be highly variable and specific to different life stages. Therefore, although ocean conditions do impact coho salmon productivity, it is difficult to determine the extent of that impact.

V. ONGOING KLAMATH RIVER BASIN CONSERVATION AND MANAGEMENT EFFORTS

This section highlights several of the broad, overarching conservation efforts and management actions currently in place to restore coho salmon and their habitat within the Klamath River Basin. Discussions that focus on smaller, more spatially focused efforts that occur at the hydrologic sub-area (HSA) scale are referred to specifically in section VI.

A. Conservation Efforts

1. Klamath River Basin Conservation Area Restoration Program

Congress authorized $1.0 M annually from 1986 through 2006 to implement the Klamath River Basin Conservation Area Restoration Program. The Klamath River Basin Fisheries Task Force (Task Force) was established by the Klamath River Basin Fishery Resources Restoration Act of 1986 (Klamath Act) to provide recommendations to the Secretary of the Interior on the formulation, establishment, and implementation of a 20-year program to restore anadromous fish populations in the Klamath River Basin to optimal levels. The 16-member Task Force included representatives from the fishing community, county, state and federal agencies, and tribes. A Technical Work Group of the Task Force provided technical and scientific input. In 1991, the Task Force developed the Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program to help direct fishery restoration programs and projects throughout the Klamath River.

In addition to creating a fishery restoration plan for the river basin restoration program, the Task Force also encouraged local watershed groups to develop restoration plans for each of the five sub-basins of the lower Klamath River. These groups included the Shasta River Coordinated Resource Management Planning Group (Shasta sub-basin), Scott River Watershed Council (Scott sub-basin), Salmon River Restoration Council (Salmon sub-basin), Karuk Tribe and Mid-Klamath Watershed Council (mid-Klamath sub-basin), and the Yurok Tribe (lower-Klamath sub-basin). A short detail of each sub-basin plan follows below. Since 1991, over $1.3 M has been

[2] Rogue River hatchery fish are used in combination with Klamath hatchery stocks as an indicator to estimate exploitation rates on wild SONCC coho salmon.

given to these groups to develop the sub-basin plans and conduct restoration activities. Funds from the Klamath Act are often leveraged to develop broader restoration programs and projects in conjunction with other funding sources, including CDFG restoration grants. As an example, nearly $1.9 M of CDFG restoration funding was spent on a variety of Klamath River Basin restoration projects during the 2002-2006 period alone. While the Klamath River Basin Conservation Area Restoration Program ended in 2006, funds were authorized for fiscal year 2007, and the USFWS continues to administer funds in the near term consistent with the goals of the program.

Shasta Sub-basin

A group of Shasta Valley landowners, in coordination with representatives of CDFG, the Natural Resources Conservation Service, the BLM and the Task Force, developed the Shasta Watershed Restoration Plan (Shasta Valley Coordinated Resources Management and Planning (CRMP) (Shasta CRMP 1997)). The CRMP focuses on areas that contain accessible salmonid habitat within the Shasta River basin (*i.e.*, below Dwinnell Dam, Parks Creek, Yreka Creek, and the Little Shasta River), and includes a description of the conditions desirable for salmon and steelhead (Biological Needs Assessment) along with a summary of current conditions in the Shasta River. A CRMP Action Plan then identifies and implements restoration work (including augmented flow levels) necessary to achieve properly functioning anadromous salmonid habitat.

Scott Sub-basin

The Scott River Watershed Council (SRWC) has developed a Scott River Watershed Strategic Action Plan (SAP) that will form the basis for setting priorities for future projects and practices supported by the SRWC, the communities within the watershed, and the many funding sources. The primary role of the plan is to inform the community about resource issues, aid in resource management, and recommend to the Siskiyou Resource Conservation District (RCD) prioritized restoration opportunities in the Scott River Watershed for funding and implementation (SRWC 2005). Ninety-three strategic actions identified in the SAP by topic and priority indicators are specified as high, medium, or low in terms of completion timeframes. Many restoration actions have been implemented within the Scott River basin since the SRWC was formed in 1992, including water conservation/irrigation efficiency projects that have saved approximately 15 cubic feet per second (cfs) of Scott River flow, approximately 18,000 feet of stream enhancement projects, and 51 diversion screens to prevent juvenile coho salmon entrainment.

Salmon sub-basin

The Salmon River Restoration Council (SRRC) was formed in 1992 to assess, protect, restore and maintain the Salmon River ecosystems with the active participation of the local community. The focus of the SRRC is restoring anadromous fisheries resources within the basin while developing a sustainable economy, a goal that can be accomplished by facilitating communication and cooperation between the local communities, managing agencies, Native American Tribes and other stakeholders. Since its inception in 1992, the SRRC has organized and guided over 8,100 volunteer days to educate the public in watershed assessement and planning, address numerous fish passage barriers, rehabilitate instream and upslope habitat, and

coordinate fire management and fuel reduction efforts. To guide upslope restoration efforts, the SRRC, in cooperation with the Klamath National Forest, recently developed the Salmon River Restoration Strategy (Elder *et al.* 2002) that outlines recommended actions to address upslope erosion hazards within high-priority tributary watersheds.

Mid-Klamath Sub-basin

The Middle Klamath River sub-basin includes the portion of the Klamath River watershed encompassing mainstem Klamath River and tributaries between the Trinity River river-mile (rm) 43 and Iron Gate Dam (rm 190). The Karuk Tribe has developed a draft Mid-Klamath Sub-basin Fisheries Resource Plan (Soto and Hentz 2003) to identify the set of core variables pertaining to ecological function in the sub-basin, and to provide management priorities and objectives to guide land managers and stakeholders in their efforts to improve conditions within the sub-basin. The tribe will administer the long-range plan, in cooperation with federal and state managing agencies, private landowners, and local communities.

The resource plan addresses the primary physical and biological processes in the sub-basin that contribute to the Klamath River's unique ecological and evolutionary attributes (most importantly, its anadromous fish runs), focusing active restoration on those processes most degraded by historic and current land uses and passive restoration for protection of currently functioning sub-basin processes.

Lower-Klamath Sub-basin

The Lower Klamath River Sub-basin Watershed Restoration Plan (Gale and Randolph 2000) was developed by the Yurok Tribe to "restore aquatic habitat conditions within the lower Klamath River tributaries to a level that supports viable, self-sustaining populations of native salmonids." The plan prioritizes restoration actions needed to accomplish this general goal, including treatement of upslope sediment sources, improvement of instream and riparian habitat function, and working closely with other land managers within the lower basin to implement best management practices for land management activities. Sound scientific methods and principles will guide the tribe's implementation of the restoration plan, including necessary monitoring to detect geomorphic and fish population response to completed restoration actions.

2. Trinity River Restoration Program (TRRP)

Restoration in the Trinity River drainage is dominated by the TRRP (USFWS 2000), which resulted from the 1984 Trinity River Basin Fish and Wildlife Management Act authorizing the Secretary of the Interior to develop and implement a management program to restore fish and wildlife populations in the Trinity River Basin to levels which existed prior to construction of the Trinity and Lewiston Dams. The current phase of the TRRP is based on the Trinity River Mainstem Fishery Restoration Environmental Impact Statement, completed in October 2000, and the Record of Decision (ROD) signed on December 19, 2000. The underlying scientific foundation of the TRRP was established through the Trinity River Flow Evaluation Final Report (USFWS/HVT 1999; hereafter referred to as flow study), an 18-year investigation authored by

the HVT and the U.S. Department of the Interior that recommended riverflow and fluvial habitat manipulations necessary to restore anadromous fish populations within the Trinity River.

Historically, the upper Trinity River functioned as a dynamic, alluvial river reach that effectively created and maintained quality spawning and rearing habitat for anadromous fish. However, the minimal static flow levels released since the completion of Lewiston Dam in 1964 were insufficient to maintain the alluvial nature of the upper river and, as a consequence, much of the river channel between Lewiston and the North Fork Trinity River confluence became confined within a narrow channel bordered by a dense riparian corridor. To "unchain" the Trinity River channel and restore river-floodplain connectivity, the program has begun mechanically removing entrenched riparian corridors and gently sloping back the streambank. To maximize the effectiveness of these physical restoration projects, the program will incorporate an annual spring peak-flow hydrograph that will restore the natural hydrologic and fluvial processes, enabling the river to once again naturally create and maintain fish habitat. The TRRP incorporates a strong scientific evaluation and modeling program to investigate fish population response to the altered flow regime and physical habitat manipulations called for within the flow study.

Several of the 47 physical restoration sites originally identified within the flow study have been implemented as of May 2007, including spawning gravel augmentation below the Lewiston Fish Hatchery and at the cableway site near the town of Lewiston, and floodplain/riparian restoration at the Hocker Flat site and Canyon Creek complex of sites. Restoration work near the Indian Creek confluence will begin in summer 2007. Higher spring flows emanating from Lewiston Dam, as called for under the flow study and ROD, have occurred on an annual basis since 2001.

3. State Recovery Strategy for California Coho Salmon

In August, 2004, the California State Fish and Game Commission listed coho salmon north of San Francisco Bay under the CESA. Coho salmon inhabiting coastal watershed between San Francisco Bay and Punta Gorda were listed as endangered under CESA, whereas coho salmon between Punta Gorda and the Oregon border were listed as threatened. The delineation of the two populations at Punta Gorda closely follows that used by NMFS when identifying the two distinct coho salmon ESUs within California (*i.e.*, the Cental California Coast and SONCC ESUs). Prior to the final listing of coho salmon under CESA, the California Fish and Game Commission directed CDFG to develop a recovery strategy for restoring native California coho salmon (Recovery Strategy). CDFG created both a multi-stakeholder Coho Recovery Team to address rangewide recovery issues, and a sub-working group (Shasta –Scott Recovery Team (SSRT)) to develop coho salmon recovery strategies associated specifically with agricultural management within the Scott and Shasta Rivers. The teams are comprised of membership from a broad range of state, federal, and local interests, including NMFS. The primary objective of the Recovery Strategy is to "return coho salmon to a level of sustained viability, while protecting the integrity of both ESUs, so they can be delisted and regulations or other protections under the CESA will not be necessary" (CDFG 2004). Appendix II of this MSRA Recovery Plan presents prioritized coho recovery actions for the Klamath River as found in the CDFG recovery strategy (CDFG 2004).

4. CDFG 1600 Incidental Take Permit for Scott and Shasta Valley Agricultural Lands

The SSRT continues to work cooperatively with CDFG on the Shasta and Scott River Watershed-wide Permitting Program (Permitting Program) being developed by CDFG in consultation with the Siskiyou RCD, Shasta Valley RCD, and agricultural operators within the Scott and Shasta River watersheds. By establishing a streamlined process for the issuance of Incidental Take Permits and Streambed Alteration Agreements, the Permitting Program would implement key coho salmon recovery tasks while facilitating compliance with CESA and Fish and Game Code section 1602, respectively. Compliance with these laws is necessary because both agricultural water diversions and agricultural land practices may adversely affect coho salmon and its habitat.

5. ESA Recovery Planning for the SONCC Coho Salmon ESU

NMFS is required by the ESA to develop recovery plans for the conservation and survival of federally-listed species. Recovery under the ESA is defined as the use of all methods and procedures which are necessary to bring any endangered or threatened species to the point at which measures provided pursuant to the ESA are no longer necessary. In 2002, NMFS began ESA recovery planning for the SONCC and Oregon Coast coho salmon ESUs through a scientific technical team created and chaired by the Northwest and Southwest Regional Fishery Science Centers, referred to as the Oregon and Northern California Coast coho salmon technical recovery team (TRT). As a part of the larger TRT, a SONCC working group is focusing on coho salmon populations within the SONCC coho salmon ESU, which includes all populations within the Klamath River basin. The final phase of recovery planning for the SONCC coho salmon ESU is underway (September 11, 2006, 71 FR 53421) and will consist of: (1) a description of management actions to achieve the plan's goals for the conservation and survival of the species; (2) objective, measurable criteria which, when met, would result in the species being de-listed; and (3) estimates of time and costs required to achieve the plan's goal and the intermediate steps towards that goal. Currently, a TRT, consisting of researchers, biologists and academics familiar with the ESU, is developing key technical information to support recovery plan development.

The initial TRT product is a description of the historic population structure of the SONCC coho salmon ESU and is presented in Williams *et al.* (2006). Williams *et al.* (2006) describe 45 individual populations across the SONCC ESU based upon their viability and independence. Populations determined to have minimal demographic influence from adjacent populations and were "viable-in-isolation" were classified as Functionally Independent populations. Populations that appeared to have been viable-in-isolation, yet demographically influenced by adjacent populations, were classified as Potentially Independent populations. Small populations of coho salmon that do not have a high likelihood of sustaining themselves over a 100-year time period in isolation and receive sufficient immigration to alter their dynamics and extinction risk were classified as Dependent populations. Ephemeral populations do not have a high likelihood of sustaining themselves over a 100-year time period in isolation, and do not receive sufficient immigration to affect this likelihood. Williams *et al.* (2006) suggest that the Klamath River Basin was comprised of nine historic populations of coho salmon (Table 3), and these population classifications will inform much of the organization of the SONCC coho salmon ESA recovery strategy. Population viability criteria defining the characteristics of sustainable populations

Table 3. Coho salmon population classification within the Klamath River Basin (from Williams *et al.* 2006).

Historic Population	Population Type	Location
Lower Klamath River	Independent	Mouth of Klamath upstream to confluence with Trinity River
Middle Klamath River	Potentially Independent	Confluence of Trinity River upstream to Portuguese Creek (inclusive in Middle Klamath); Seiad and Grider Creeks in Upper Klamath River Basin
Upper Klamath River	Independent	Portuguese Creek (non-inclusive) upstream to Spencer Creek (inclusive)
Salmon River	Potentially Independent	
Scott River	Independent	
Shasta River	Independent	
Lower Trinity River	Potentially Independent	Confluence of Klamath River upstream to confluence with North Fork Trinity River (non-inclusive)
Upper Trinity River	Independent	Confluence of North Fork Trinity River (inclusive) upstream to Ramshorn Creek (inclusive)
South Fork Trinity River	Independent	

within the ESU are expected to be released in summer 2007. Finally, the TRT will develop a list of research and monitoring needs specific to the SONCC coho salmon ESU to identify information gaps and address uncertainties. Taken together, these TRT products will provide the scientific "building blocks" of the SONCC coho salmon recovery plan.

Fundamental to the SONCC coho salmon recovery plan will be a comprehensive threats assessment for the individual populations identified in Williams *et al.* (2006). The threats assessment will be an extensive compilation and synthesis of existing data, as well as input and technical review from an array of individuals that have knowledge of the species and conditions it faces. This threats assessment will identify key limiting factors for the various life history stages of coho salmon across the ESU, including populations within the Klamath River Basin. The threats assessment, in conjunction with the population viability criteria, will facilitate the development of focused and prioritized recovery actions. NMFS is currently working with various co-managers in both Oregon and California to develop a draft recovery plan.

As detailed above, the TRT will describe the criteria for restoring to a viable status those historic populations deemed essential for recovery. The concept of Viable Salmonid Populations (VSP) is described in McElhaney *et al*. (2000) and consists of four population viability parameters: abundance, population growth rate (productivity), spatial structure and population diversity. Thus, for populations to be considered viable, they must not only possess a minimum level of abundance and productivity, but must also be well distributed across their current range and encompass a range of genetic and biological diversity that is capable of withstanding environmental variation over long time periods. The criteria under development by the TRT will apply these VSP concepts to the SONCC coho salmon ESU. Guided by these VSP concepts and the TRT information, the federal ESA recovery plan will provide the road map for achieving viable coho salmon populations. Finally, these viable populations will be aggregated across

major population groups to exemplify a sustainable coho salmon ESU that no longer warrants listing under the ESA.

6. NMFS and CDFG Restoration Grant Programs

NOAA administers several grant programs to further restoration efforts in the Klamath River Basin. Since 2000, NMFS has issued grants to the States of California and Oregon, and Klamath River Basin tribes (Yurok, Karuk, Hoopa Valley and Klamath) through the Pacific Coast Salmon Restoration Fund (PCSRF) for the purposes of restoring coastal salmonid habitat. From 2000 through 2005 (2006 data are not yet available), NMFS issued grants of nearly $13.9 M to California and $6.2 M to Klamath River Basin tribes that funded restoration projects within the Klamath River basin. California integrates the PCSRF funds with their salmon restoration funds and issues grants for habitat restoration, watershed planning, salmon enhancement, research and monitoring, and outreach and education. These projects include a wide range of activities, including establishing conservation easements; conducting road inventories and restoration; improving fish passage; fostering public outreach and watershed planning; riparian fencing; and species and habitat monitoring. Through the use of federal, state, tribal and local funds, over 360 projects have been funded in the Klamath River Basin. The NOAA Restoration Center administers several types of grants programs that have provided funding to support Klamath River restoration efforts.

In 2006, the State of California dedicated an additional $10 M toward restoration actions specifically identified within the Klamath River Basin. The program funded 26 restoration projects within Humboldt and Siskiyou Counties that remove permanent or seasonal barriers to otherwise functioning historical salmonid habitats; prevent entrapment of juvenile salmonids; improve streamflows that benefit spawning access or rearing areas for salmonids; and install instream habitat improvement structures that recruit and sort spawning gravel and create summer rearing and over-wintering habitat for juveniles. Critical limiting factors addressed through the program include improving fish passage and summer water quality by removing several flashboard dams on the mainstem Shasta River.

B. Management Efforts

1. Federal Energy Regulatory Commission (FERC) Re-licensing of the Klamath Hydroelectric Project

PacifiCorp's FERC license for the Klamath Hydroelectric Project (Project), which includes four dams on the mainstem Klamath River, expired on March 1, 2006. Until a new license is issued, PacifiCorp will operate the Project under an annual license with the same terms and conditions of the existing license. The existing license contains no provision for passage of anadromous salmon, steelhead and lamprey. Under the Federal Power Act, the Secretary of Commerce and the Secretary of the Interior have the discretionary authority to prescribe that fish passage be included as a mandatory condition in new hydropower licenses.

In March 2006, the Department of Commerce and the Department of the Interior filed with FERC joint preliminary fishway prescriptions for the relicensing of the Project. The

Departments filed their joint modified (final) fishway prescriptions in January 2007. Among other things, the modified prescriptions take into account the following: findings of fact issued by an Administrative Law Judge in September 2006 after a hearing on disputed issues of material fact regarding the Departments' joint preliminary fishway prescriptions; FERC's draft environmental impact statement, which was also issued in September 2006; an alternative to the Departments' joint preliminary fishway prescriptions proposed by PacifiCorp; and public comments. These are among the first fishway prescriptions issued in the nation to have gone through the hearing and alternative procedures created by Congress in the Energy Policy Act of 2005. In his ruling, the Administrative Law Judge found that providing fish passage into the Project reach would benefit coho salmon (Administrative Law Judge Decision 2006).

Like the USFWS/NMFS March 2006 preliminary prescriptions for the Klamath Dams, the modified prescriptions include fish passage, both upstream and downstream, for the Project's Iron Gate, Copco I and II and J.C. Boyle dams. However, the January modified prescriptions were changed to provide a lower cost alternative for down stream passage at Copco Dam, a less prescriptive approach for tailrace barriers and spillway modifications, and to clarify the description of attraction flows. The Departments of Commerce and the Interior did not adopt the long-term adaptive trap and haul alternative proposed by PacifiCorp. After conducting a full analysis, the Departments concluded that PacifiCorp's alternative was less protective than the Departments' joint prescriptions for volitional fish passage for the Project.

In the project area, the fishway prescriptions would restore access to approximately 58 miles of habitat for Chinook salmon and steelhead, provide access to this habitat for Pacific lamprey, and improve habitat connectivity for resident redband trout. This includes approximately 46 miles of habitat (mainstem and tributary) for threatened coho salmon. Fish passage could also result in the reintroduction (return) of Chinook salmon, steelhead and lamprey to more than 350 miles of habitat from which they were excluded by construction of the first dam in 1918.

2. Reclamation's Klamath Project Operations

NMFS issued a biological opinion on the effects of Reclamation's Klamath Project Operations on SONCC coho salmon on May 31, 2002, concluding that Reclamation's proposed 10-year operation would jeopardize the continued existence of SONCC coho salmon (NMFS 2002). For this reason, NMFS developed, with Reclamation, a reasonable and prudent alternative (RPA) consisting of the following elements: (1) water management measures over the next 10 years structured in three phases; (2) a water bank program to provide flows to the Klamath River to improve coho salmon habitat; (3) an agreed upon long-term flow target to be achieved by 2012; (4) an inter-governmental task force to develop, procure, and manage water resources in the Klamath River Basin (Conservation Implementation Program); and (5) an inter-governmental science panel to develop and implement a research program to identify and fill gaps in existing knowledge regarding coho salmon and their habitat requirements during various life history stages and water-year types.

On March 27, 2006, U.S. District Judge Saundra Armstrong issued an order granting a motion for injunctive relief following remand of NMFS's 2002 biological opinion on Reclamation's 10-year Klamath Project (Pacific Coast Federation of Fisherman's Association vs. U.S. Bureau of

Reclamation and NMFS, No. C02-2006 SBA). Specifically, Judge Armstrong ordered: (1) NMFS and Reclamation to reinitiate consultation on the Klamath Project and (2) Reclamation to limit Klamath Project irrigation deliveries if they would cause water flows in the Klamath River at and below Iron Gate Dam to fall below 100 percent of the long-term flows specified in NMFS' 2002 biological opinion, until a new consultation is completed.

NMFS and Reclamation have begun exploring approaches to the next section 7 consultation on the Klamath Project. NMFS will be considering a suite of new information in its next consultation with Reclamation, including the Evaluation of Instream Flow Needs in the Lower Klamath River Final Report (INSE 2006, also known as "Hardy Phase 2 report"), Reclamation's Undepleted Natural Flow Study (Reclamation 2005), as well as TRT documents related to SONCC coho salmon population structure (*e.g.*, Williams *et al.* 2006). NMFS will also consider the results from the NRC review of the Hardy Phase 2 report and the undepleted natural flow study, which are expected in October 2007.

3. Hatchery and Genetics Management Plan (HGMP) development

For much of the last century, fish hatcheries have been viewed as a substitute for addressing declining salmonid abundance caused by lost or degraded habitat, blocked migration, and overharvest. While "mitigation" hatcheries have been largely successful in replacing lost natural production, genetic and ecological impacts can result as hatchery fish interact with natural populations (Waples 1991; CDFG and NMFS 2001).

On June 28, 2005 (70 FR 37160), NMFS adopted a rule under section 4(d) of the ESA prohibiting the take of 20 groups of threatened salmon and steelhead. In addition to prohibiting take of threatened salmon and steelhead, the rule also included a set of 13 limits on the application of the ESA take prohibitions for specific categories of activities that contribute to the conservation of the listed salmon and steelhead or adequately limit their adverse impacts. With regard to fish hatchery impacts, the section 4(d) rule does not prohibit take of listed fish for a variety of hatchery purposes if a state or federal management agency develops an HGMP and NMFS approves it. An HGMP is currently being drafted for the Trinity River Hatchery by a multi-agency/tribal technical team in order to limit adverse impacts on SONCC coho salmon and achieve compliance under the ESA. CDFG submitted a draft HGMP for Iron Gate Hatchery to NMFS in June 2006, but both agencies decided to suspend action on the plan in light of the impending FERC relicensing of the Klamath Hydroelectric Project.

4. Five Counties Road Maintenance Program

Limit Number 10 of the ESA section 4(d) rule pertains to take of threatened salmon and steelhead arising from routine road maintenance. Specifically, the limit does not prohibit take resulting from routine road maintenance conducted by the employees or agents of a state, county, city, or port under a program that complies substantially with the "Transportation Maintenance Management System Water Quality and Habitat Guide (Oregon Department of Transportation (ODOT) 1999). To qualify their road programs under Limit 10, Humboldt, Del Norte, Trinity, Siskiyou and Mendocino Counties (Five Counties) collaboratively developed the "Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California

Watersheds" (Five Counties Salmon Conservation Program 2002; hereafter referred to as "Manual"), which is based largely on ODOT (1999). The Manual includes design and construction guidelines and best management practices that minimize erosion and rectify fish passage problems. Since 1998, the Five Counties have repaired or replaced 48 faulty road culverts, increased available fish habitat by 119 miles, and completed Road Erosion Inventories on over 2,000 miles of road (Five Counties Salmonid Conservation Program 2006). NMFS is in the process of reviewing the County's Routine Road Maintenance Plan and expects to make a determination under Limit Number 10 in summer 2007.

5. Green Diamond Habitat Conservation Plan (HCP)

Along the lower Klamath River, Green Diamond Resource Company (Green Diamond) owns and manages approximately 265 square miles of lands below the Trinity River confluence for timber production. The company has completed an HCP (Green Diamond 2006) for aquatic species, including SONCC coho salmon, and NMFS issued an ESA section 10(a)(1)(B) Incidental Take Permit on June 12, 2007. A key element of the HCP is prioritization and treatment of high- and moderate-priority road erosion sites. As part of the HCP, Green Diamond has prioritized road work for 30 sub-basins across its lower Klamath River holdings. The HCP commits Green Diamond to repairing approximately half of its high- and moderate-priority sites, property-wide, over the first 15 years of implementation. Within the lower Klamath watershed, the work will be accomplished through the joint efforts of Green Diamond and the Yurok Tribe.

6. Northwest Forest Plan (NFP)

The NFP is an integrated, comprehensive design for ecosystem management, intergovernmental and public collaboration, and rural community economic assistance for federal forests in western Oregon, Washington, and northern California. The essential component of the NFP is an Aquatic Conservation Strategy that conserves and protects aquatic and riparian dependent species, specifically anadromous salmonids and their critical habitats. Since adoption of the NFP in 1994, timber harvest and road building have decreased dramatically on federal lands within the range of the Northern spotted owl, including federal lands within the Klamath River Basin (*i.e.*, Six Rivers, Klamath, and Shasta-Trinity National Forests (NF)). The reduction in timber harvest will likely increase LWD levels, decrease stream temperatures, and decrease sediment delivery to the aquatic environment, all of which will ultimately aid SONCC coho salmon recovery. Adoption and implementation of the NFP has also reduced road construction on federal lands within the Klamath River Basin. This reduction in new road construction will result in less road-related impacts on SONCC coho salmon habitat. Also, since implementation of the NFP began in 1994, there have been at least 450 miles of roads decommissioned on the Klamath, Six Rivers, Mendocino, and Shasta-Trinity NF. Road decommissioning reduces chronic erosion delivery to streams and decreases the potential for catastrophic delivery of road-related sediment, especially sediment associated with stream crossing failure. In addition to the restoration and conservation principles resulting from NFP implementation, the three Klamath River Basin River NFs (Klamath NF, Six Rivers NF, and Shasta-Trinity NF) have accomplished signficant restoration results through their individual land and resource management plans. For instance, the Klamath NF recently reconstructed 20 existing USFS-administered road crossings

by installing open-bottomed crossings to reestablish natural stream bottom configuration and achieve fish passage objectives.

7. California Forest Practice Rules

Timber harvest on private land is regulated and enforced through Forest Practice Rules (Rules) by the California Department of Forestry (CDF). During the listing process for Northern California Steelhead (*O. mykiss*) in 2000, NMFS reviewed the Rules and concluded they do not adequately protect anadromous salmonids or provide for properly functioning habitat conditions. As a result of the listing of Northern California steelhead under the ESA, CDF imposed stricter guidelines to protect and restore watersheds with threatened or impaired values (T&I Rules) beginning on July 1, 2000. The T&I Rules minimize impacts to salmonid habitat resulting from timber harvest by requiring special management actions in planning watersheds where populations of anadromous salmonids listed as threatened, endangered, or candidate under the state or federal ESA currently preside or are restorable. Examples of the special management actions required include constructing watercourse crossings that allow for unrestricted fish passage, increasing large woody debris recruitment, increasing soil stabilization measures, and requiring coordination between CDF and the State and Regional Water Quality Control Boards to minimize sediment discharge. The T&I Rules have not been permanantly adopted, but instead have been reauthorized by CDF several times since their inception in 2000.

8. Total Maximum Daily Load (TMDL) development

Under section 303(d) of the Clean Water Act of 1972, the State Water Resources Control Board and the United States Environmental Protection Agency (USEPA) are authorized to establish water quality standards through development of TMDLs that ensure the protection of identified beneficial uses. To begin the TMDL process, waterbodies are first evaluated as to whether they are meeting water quality standards and designated beneficial uses. If not, waterbodies are placed on the section 303(d) list of impaired waterbodies (USEPA 2003), which triggers the development of a water pollution control plan (*i.e.*, a TMDL). A TMDL provides a quantitative assessment of water quality problems, contributing sources of pollution, and the pollutant load reductions or control actions needed to restore and protect the beneficial uses of an individual waterbody impaired from loading of a particular pollutant.

The entire mainstem Klamath River below Iron Gate Dam is impaired by high nutrient levels, low dissolved oxygen levels, and elevated water temperatures. A TMDL addressing this reach is expected to be finalized sometime in 2009. Major Klamath River tributaries (*i.e.*, Trinity, South Fork Trinity, Salmon, Scott and Shasta Rivers) are also listed as water quality impaired for various pollutants, and each has a completed TMDL in place.

9. Natural Resource Conservation Service (NRCS) Programs

The NRCS continues to provide assistance to farmers and ranchers in the Klamath River Basin for planning and application of conservation practices that include reducing agricultural demand for water, improving hydrologic conditions, and restoring habitat and water quality for fish and wildlife. Through the NRCS Farm Bill programs, conservation systems are being implemented

on private lands using the best applied science. Future efforts will be increasingly effective as the NRCS, conservation districts, and landowners gain experience from the practices currently applied.

10. Fish Passage Forum

In November 1999, the California Resources Agency convened a group of interested state, local and federal agencies, fisheries conservation groups, researchers, restoration contractors, and others to discuss ways to restore and recover anadromous salmonid populations by improving fish passage at fabricated barriers. Now recognized as the Fish Passage Forum, this diverse group meets on a quarterly basis to promote the protection and restoration of listed anadromous salmonid species in California, primarily by encouraging collaboration among public and private sectors for fish passage improvement projects and programs. The Fish Passage Forum's work not only includes identifying and inventorying known barriers, but also entails assisting fish passage restoration through streamlined permitting and providing fish passage education to the public. Although the Forum addresses fish passage issues throughout all anadromous state waters, a large number of projects have resolved passage issues within the Klamath River Basin.

11. Harvest Management

Coho salmon have been harvested in the past in both coho- and Chinook-directed ocean fisheries off the coasts of California and Oregon. More stringent management measures that began to be introduced in the late 1980s have reduced coho salmon harvest substantially. Initial restrictions in ocean harvest were due to changes in the allocation of Klamath River fall-run Chinook salmon (KRFC) between tribal and non-tribal fisheries. These restrictions focused on the Klamath Management Zone where the highest KRFC impacts were observed (Good *et al*. 2005). Subsequent regulations designed specifically to protect coho salmon were implemented beginning in 1993 when the retention of coho salmon in ocean commercial fisheries was prohibited from Cape Falcon, Oregon south to the U.S./Mexico border. The following year, coho salmon retention was prohibited in ocean recreational fisheries from Cape Falcon, Oregon to Horse Mountain, California, and expanded to include all California waters in 1995. With the exception of some mark-selective recreational coho salmon fisheries that have taken place in recent years in Oregon waters that only allow hatchery coho salmon marked with a healed adipose fin clip to be retained, these prohibitions have remained in effect south of Humbug Mountain, Oregon (where the Pacific Fisheries Management Council (PFMC) estimates the majority of SONCC coho salmon harvest occurs) since their original implementation (PFMC 2007, Good *et al*. 2005).

Each year during the ocean salmon fishery preseason planning process, NMFS provides guidance to the PFMC on actions necessary to protect species listed under the ESA. For federally listed coho salmon stocks in California, this guidance is supplied by the RPA of the NMFS 1999 Supplemental Biological Opinion and Incidental Take Statement for SONCC and CCC coho salmon (NMFS 1999). Insufficient data on the natural escapement of coho salmon in the Klamath River (and California rivers in general) make the status of parent spawner recruitment difficult to assess. Because there are also no data available on exploitation rates on wild SONCC coho salmon, Rogue and Klamath River hatchery stocks are used as an indicator to

estimate those exploitation rates. The conservation objectives established in the RPA require that no directed coho salmon fisheries or retention of coho salmon in Chinook salmon-directed fisheries be allowed off California and that management measures developed under the Fishery Management Plan (FMP) be designed to achieve an ocean exploitation rate on Rogue/Klamath hatchery coho salmon stocks of no more than 13 percent to protect CCC and SONCC coho salmon, respectively. As previously mentioned, coho salmon retention has been prohibited off the coast of California and the southern portion of Oregon for over a decade. With the exception of some authorized harvest by the Yurok, Hoopa Valley and Karuk tribes for subsistence, ceremonial and commercial purposes[3], the retention of coho salmon is also prohibited in California river fisheries. In order to comply with the SONCC coho salmon conservation objective, projected exploitation rates on Rogue/Klamath River hatchery coho salmon stocks are calculated during the preseason planning process using the coho salmon Fishery Regulation Assessment Model (FRAM, Kope 2005). Season options are then crafted that satisfy the 13 percent maximum ocean exploitation rate. In recent years, these rates have been well below 13 percent with five of the last eight years at or below 6 percent and no year exceeding 9.6 percent. Post-season estimates are not performed due to a lack of information necessary to generate accurate expansions of inriver coded wire tag (CWT) recoveries (Kope 2005).

Although the conservation objectives discussed above are designed to protect a broad range of coho salmon populations in California, they also provide adequate protection for Klamath River coho salmon with respect to harvest related mortality until monitoring programs can be developed that will allow a better assessment of population trends. Therefore, with harvest restrictions in place through state and federal regulations that prohibit fishing for or retaining coho salmon in California, NMFS is confident that any existing harvest impacts to Klamath River coho salmon play a minor role in their viability and that habitat needs must now be addressed.

VI. THREATS TO COHO SALMON HABITAT AND RECOMMENDED RESTORATION ACTIVITIES

Fishing for coho salmon in the Klamath River and in the ocean has likely effected the viablity of coho salmon populations in the past and was one of the factors that led to SONCC coho salmon's threatened status under the ESA. These direct impacts have been addressed in both State and Federal regulations that prohibit fishing for and retaining coho salmon. With those protections in place, the habitat needs of coho salmon now must be met, as well as addressing potential impacts associated with hatcheries. Since coho salmon do not, for the most part, spawn and rear within mainstem river habitat, restoration efforts should focus on addressing habitat limitations within critical tributary watersheds (NAS 2004). For example, chronic erosion from roads, timber-harvest areas and recently burned forestland simplifies instream habitat, raises turbidity levels, and indirectly elevates water temperatures. Federal, state and local restoration efforts continue to address the many factors limiting salmon production within the basin by addressing upslope

[3] Good et al. (2005) reported that coho salmon harvest by the Yurok tribe, which were the only tribal harvest data available, ranged from 42 to 135 fish between 1997 and 2000 and increased to 895 fish in 2001. The majority of this catch (63-86 percent) was comprised of hatchery fish.

sediment sources, improving instream flow levels, replacing legacy road crossings that impede fish passage, and removing dangerous understory fuels that precipitate catastrophic forest fires. However, much restoration work remains before instream habitat conditions within the Klamath River, as a whole, is of the quality and quantity necessary to support viable and robust coho salmon populations.

This section provides a synopsis of specific threats and recommended restoration actions at the hydrologic unit (HU), hydrologic area (HA), and hydrologic sub-area (HSA) levels (Figure 3). Each task has been identified as a high priority in restoring anadromous fish populations and habitat within the Klamath River Basin. Much of the information presented below is synthesized from the CDFG coho salmon recovery strategy (CDFG 2004), along with USFS watershed analyses and various individual sub-watershed management plans where noted. Appendix I summarizes threats to coho salmon and their habitat at the HSA level across the Klamath River Basin.

A. Klamath River HU

The Klamath River HU covers approximately 1,531 square miles of the mainstem Klamath River and associated tributaries (excluding the Trinity, Salmon, Scott and Shasta sub-basins) from the estuary to above Copco Reservoir. Although anadromous fish passage is currently blocked at Iron Gate Dam (rm 190), coho salmon were once common and widely distributed within the Klamath River watershed, likely inhabiting mainstem and suitable tributary habitat up to and including Spencer Creek (rm 228). Today, coho salmon occupy a small fraction of that historical area, primarily restricted to small pockets of tributary habitat where suitable conditions persist (NAS 2004).

The Klamath River drainage suffers from many natural and anthropogenic impairments that limit coho salmon production. Foremost is the over-allocated nature of water resources throughout the mainstem Klamath River and major sub-basins, which is generally acknowledged as the primary mechanism responsible for the poor water quality, elevated disease incidence, and impaired passage conditions common to much of the Klamath River Basin. Intensive studies aimed at identifying flow levels necessary to protect salmon and maximize instream habitat levels are ongoing or undergoing review at this time (*e.g.*, Hardy Phase 2), and federal, state and local water managers will need to consider study recommendations as part of the overall goal of managing both anadromous fish production and local economies dependent on Klamath River water allocation. Restoration funds can restore impaired water quality conditions by rehabilitating degraded tributary habitat, such as addressing upslope sediment sources that can lower pool volumes and decrease stream depth, or by restoring riparian function to increase streamside shading.

Dams and improperly designed road crossings are obvious impediments to coho salmon passage within the Klamath River Basin, but other less obvious mechanisms can negatively influence fish migration. Research has demonstrated that upstream migration of Klamath River Chinook salmon is suppressed at mean daily water temperatures above 23.5°C if temperatures are falling,

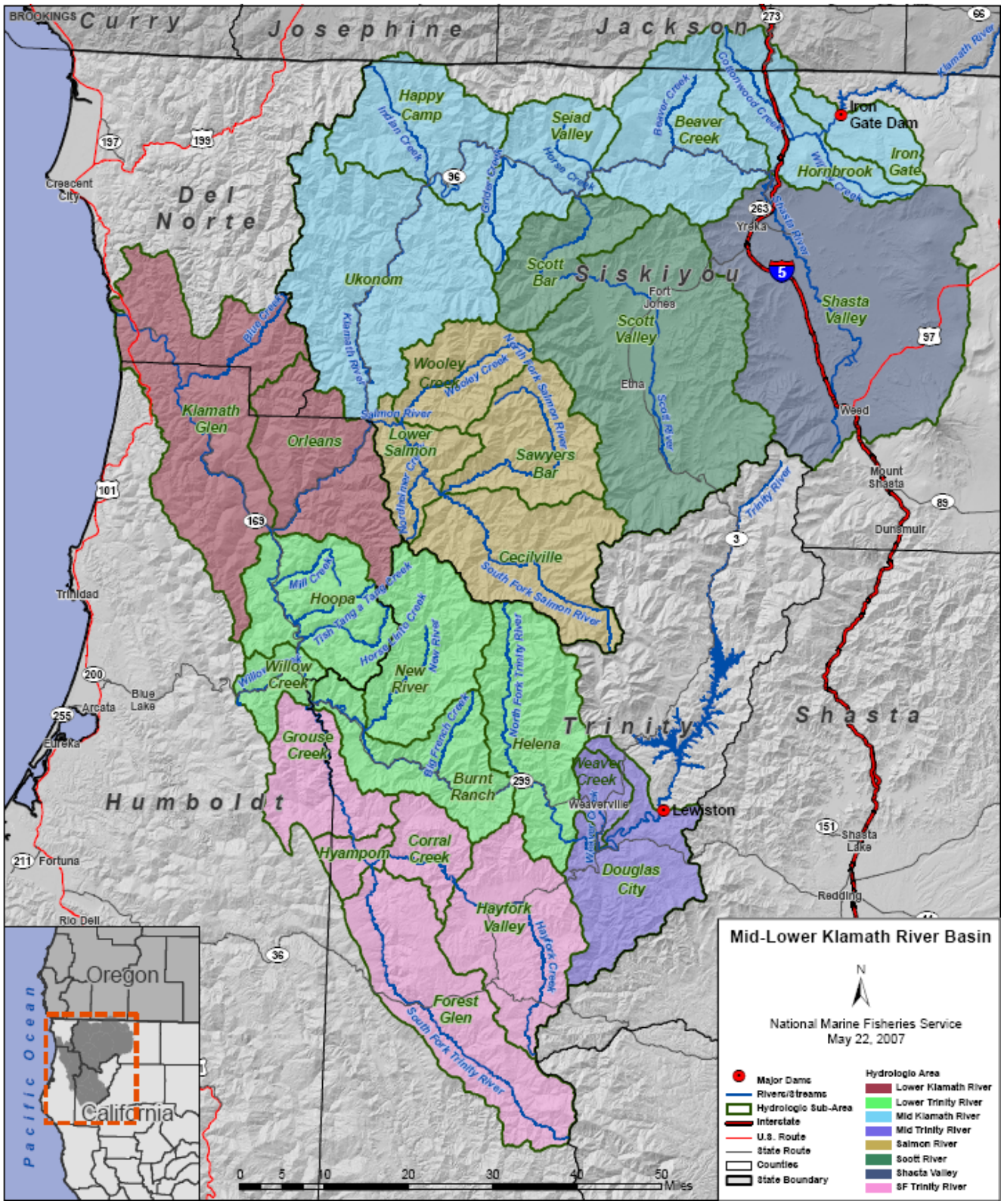


Figure 3: Map of the Klamath and Trinity River basins showing the Hydrologic Areas used in the the CDFG Recovery Strategy for California Coho Salmon (CDFG 2004).

below 21.0°C if temperature are rising, and above 22.0°C if temperatures are stable (Strange 2007). Insufficient flushing flows can lead to the formation of gravel/sediment berms at tributary confluences, likely impairing adult migration into natal tributary spawning habitat. Preserving cold tributary streamflows and implementing higher mainstem "channel maintenance" flows could alleviate these issues and increase fish passage opportunities within the Klamath HU. Furthermore, removing or modifying the Pacificorp hydropower project with fish ladders could allow coho salmon passage into 30 miles of historic mainstem habitat located above the dams (Hamilton *et al.* 2005). A group representing federal, state, and local governments, as well as other non-governmental groups, is currently discussing passage and dam decommissioning options as part of FERC's proposed relicensing of Pacificorp's project. The outcome of these proceedings has the potential to substantially benefit salmon populations within the basin.

Fish disease mechanisms are poorly understood within the Klamath River Basin, but researchers suspect low flows and modification of the historic hydrologic regime, combined with poor water quality, have created instream conditions that favor disease proliferation and fish infection. High water temperatures stress adult fish and slow upstream migration rates, facilitating parasite transmission between healthy and sick fish as they congregate in the few cold water refugial areas of the lower Klamath River (USFWS 2003). Similarly, juvenile infection rates have increased in the past several years as instream habitat conditions suited to the parasites (*Ceratomyxa shasta* and *Parvicapsula minibicornis*) and their intermediate hosts have expanded spacially and temporally as drought and water diversions alter the natural hydrology of the basin. Disease monitoring and investigation of the dynamics relating to each parasite's life-cycle and the factors influencing infection rates are critical to implementing restoration measures necessary to bring parasite/host populations to more natural levels.

1. Klamath Glen HSA

This lowest section of the Klamath River extends from the river mouth to its confluence with the Trinity River. Yurok Tribal lands extend upslope for 1 mile from each river bank in this reach; beyond tribal land, much of the tributary habitat extends into timber production land owned by Green Diamond. Although the Klamath River estuary is, for the most part, largely intact and unaffected by urban encroachment, several factors limit its ability to support properly functioning habitat for anadromous salmonids. As part of their ongoing coho salmon overwintering study, the Yurok Tribe has documented substantial use of off-channel habitat by juvenile coho salmon within non-natal tributaries of the Klamath River estuary (Voight 2007). Preliminary results from the study suggest displaced fish exhibit high fidelity with regard to this non-natal habitat, as well as a greater fitness level at the smolt stage as compared to fish that overwintered solely within their natal tributary. The lower reaches of estuarine tributaries such as Salt Creek, Hunter Creek and Terwer Creek often suffer from poor water quality and compromised riparian function, primarily due to unregulated cattle grazing adjacent to the stream channel. Riparian fencing projects implemented in cooperation with willing landowners would immediately improve habitat conditions within these critical watersheds by minimizing streambank erosion and rehabilitating riparian habitat, but further study will ultimately be necessary to fully understand how the lower Klamath River estuary and associated off-channel habitat function to provide for the different life stages of anadromous salmonids.

Several large tributaries in the Klamath Glen HSA historically supported healthy coho salmon populations, but timber harvesting and construction of the associated road network has impaired instream habitat conditions throughout much of the HSA. For example, McGarvey, Tarup, Tectah, and Ah Pah Creeks all suffer from excessive sediment input that has simplified instream habitat, limited food production, and lowered spawning and rearing success. In some tributaries, large sediment loads have accumulated at their confluence with the Klamath River, potentially interrupting tributary dispersal of coho salmon during winter months (Voight and Gale 1998). Moreover, many road crossings still exist that impede or prevent fish passage. Much effort and resources have been expended to upgrade failing road crossings and control upslope sediment sources through road decommissioning and upgrading. However, continued work along these lines will be necessary to fully restore the functioning of these critical watersheds.

Blue Creek is one of the few lower Klamath River tributaries that is relatively intact with regard to habitat function. The confluence of Blue Creek with the Klamath River regularly provides an area of cool, high quality water that functions as refugial habitat for adult salmon migrating through the lower Klamath River during late summer/early fall. Thus, protection and maintenance of the Blue Creek watershed is of utmost importance to the health of the lower Klamath River, and several key restoration actions are needed in this regard. Grazing by feral cattle has severely degraded riparian function within the lower Blue Creek watershed, simplifying the composition of riparian species and weakening streambank structure. Removing the cattle will help improve streambank stability and minimize erosion. To increase riparian species diversity and promote recruitment of functional LWD into the stream environment, revegetation efforts emphasizing conifer recruitment should be a part of riparian restoration projects. Even though the upper half of the Blue Creek watershed is publicly owned (Siskiyou Wilderness Area), the watershed is still hampered by elevated instream sediment conditions resulting from anthropogenic upslope erosion (mainly from poorly-built road networks) and in need of upslope restoration.

2. Mid-Klamath HSAs

For the most part, the mid-Klamath HSAs (Orleans, Ukonom, Happy Camp, Seiad Valley, Beaver Creek, and Hornbrook) suffer similar limiting factors with regard to coho salmon habitat and production. Therefore, to avoid redundancy, this section speaks generally of the restoration needs common to the entire mid-Klamath reach. Recommendations specific to a given HSA will follow.

Many mid-Klamath tributaries provide summer cold water accretion to the mainstem Klamath River when water quality conditions in the basin are often compromised. Therefore, the overriding restoration priority should be the restoration and maintenance of cool, high quality tributary streamflow. A review of current water allocations and the use of a watermaster to ensure water right compliance could significantly improve instream flows during periods deemed critical to juvenile coho salmon survival. Also, purchasing water-rights from willing landowners represents an effective means to dedicate high-quality surface flows to instream beneficial use. Where water rights cannot be purchased, efforts should be made to encourage landowners to incorporate innovative water-saving measures to foster efficient use of water resources.

Riparian restoration is another tool that can significantly improve water quality in adjacent stream channels. Many tributaries of the mid-Klamath region are lacking large, functional LWD input, specifically coniferous species. Forestry practices that improve existing riparian zones by emphasizing native species and conifer recruitment during riparian planting projects and removal of alders and himalayan blackberry should be encouraged. Once riparian corridors have been restored, riparian fencing should be utilized to prevent future degradation in areas where cattle grazing occurs adjacent to the stream channel.

Implementing measures to reduce sediment input from upslope sources is critically necessary within the mid-Klamath River HSA, where vast road networks continue to degrade and contribute fine sediment into the stream environment. Little-used road segments and skid trails should be decommissioned when possible; those not decommissioned should be upgraded and maintained to reduce hydrologic connectivity between upslope road surfaces and the aquatic environment. Large, severe wildland fires can also precipitate chronic sediment routing between upslope sources and stream channels, particularly when coupled with salvage logging. Landscapes scorched by intense fire lose soil integrity as plant and tree roots degrade, triggering landslides that introduce large quantities of sediment into creeks and rivers. Re-establishing a more natural fire regime of smaller, more frequent controlled burns can help prevent the buildup of understory vegetation that fuel large, hot, catastrophic fires.

Finally, in light of the heavy road development within much of the HSA, impaired fish passage at road crossings is commonly a bottleneck to migrating coho salmon. Many roads administered by the California Department of Transportation have faulty or poorly designed culverts that block upstream and downstream migration. Problem culverts should first be inventoried and ranked in order to optimize use of limited funding resources. Another less obvious fish passage impairment can occur at stream diversion structures, where improperly screened intake pipes and canals can entrain juvenile coho salmon. These losses can be minimized by working with local agricultural and municipal diverters to ensure diversion structures are properly equipped with fish screens consistent with NMFS guidelines (NMFS 1997).

a. Orleans HSA

The Orleans HSA is the portion of Klamath River watershed beginning at the Trinity River confluence and extending upstream to the Salmon River. Many tributaries within this reach support coho salmon populations, and several require special management consideration. Bluff and Red Cap Creeks contain quality coho salmon habitat and have been designated by the USFS as key watersheds under the NFP (Forest Ecosystem Management and Assessment Team 1993). Key watersheds serve as biological refugia for maintaining and recovering habitat for stocks of anadromous fish at risk, such as coho salmon. Likewise, Boise and Camp Creeks have been identified as high priority tributaries for coho salmon spawning and rearing. Restoration actions should focus on maintaining these areas of high-quality coho salmon habitat.

b. Ukonom HSA

The Ukonom HSA extends from the Salmon River confluence upstream to Indian Creek and contains several tributaries that historically supported coho salmon. Juvenile coho salmon migration between mainstem and tributary habitat is often compromised in this reach by faulty stream crossings along Highway 96. Low tributary flow can also curtail passage at tributary confluences where high sediment loads aggrade and force streamflow subsurface. Stanshaw, Sandy Bar and Coon Creeks have been identified as needing fish passage remediation.

c. Happy Camp HSA

The Happy Camp HSA is located between the confluence of Indian Creek and Grider Creek. Upstream fish passage concerns have been documented along Highway 96 at Cade, Portugese and Fort Goff Creeks. Restoration work should focus on replacing/retrofitting these crossings to ensure they meet NMFS fish passage requirements (NMFS 2001).

d. Seiad Valley HSA

The Seiad Valley HSA extends from Grider Creek upstream to and including the Horse Creek drainage. Fish passage and riparian problems exist in Seiad Creek, where road crossings impede fish passage and degrade riparian functions (USDA 1999a). A private water diversion on Middle Creek (tributary of Horse Creek) may impede coho salmon passage and should be investigated.

e. Beaver Creek HSA

The Beaver Creek HSA encompasses the portion of the Klamath River between Horse Creek and the Shasta River confluence. Many of the larger tributaries within the Beaver Creek and Seiad Valley HSAs suffer from low pool frequency, elevated fine sediment, low LWD levels, low streamflow and high water temperatures (USDA 1993). A specific problem area within the Beaver Creek HSA is West Fork Beaver Creek, where Beaver Creek Road continues to supply high levels of sediment to the waterway. To correct this problem, the road should either be upgraded or decommissioned, depending on the level of anticipated future use. Fish passage barriers in lower Horse and Collins Creeks should be fixed. Over half of the Beaver Creek HSA is made up of private land inholdings within the national forest system; therefore, a coordinated effort toward fish passage restoration must be developed with support from private land owners within the HSA.

f. Hornbrook HSA

The Hornbrook HSA, which extends from the confluence of the Shasta River upstream to Little Bogus Creek, is plagued by low recruitment of mainstem spawning gravel and diminished flushing flows caused largely by the presence of Iron Gate Dam immediately upstream. The HSA has two large tributaries, Willow Creek and Cottonwood Creek, which historically provided productive coho salmon spawning and rearing habitat. Today, both subwatersheds have experienced anthropogenic degradation largely resulting from agricultural/livestock encroachment close to the stream channel and excessive water diversions, and, as a result,

sightings of coho salmon are now rare. Restoration funding should first focus on improving fish passage within the HSA (there currently exists a large, impassable impoundment on mainstem Cottonwood Creek). Additionally, cooperatively working with farmers and landowners to preserve cold instream flows during summer months should greatly improve over-summer rearing habitat for juvenile fish.

B. Salmon River HU

The Salmon River watershed drains an area of 751 square miles predominantly comprised of federal land (approximately 90 percent). Because of the large area of public land, the Salmon River Basin is sparsely populated and, therefore, does not suffer water quality and quantity issues to the same degree as the rest of the Klamath River Basin, although the river is currently listed by the state as impaired due to high nutrient levels and water temperature. Sediment emanating from the basin's road network is the predominate factor affecting instream habitat quality within the basin. For the most part, the Salmon River Basin is ill-suited for high coho salmon production, with much of the watershed dominated by bedrock-confined tributaries of moderate to steep gradients instead of the low-gradient, alluvial channels generally preferred by coho salmon for spawning and rearing. Despite this shortfall in suitable habitat, the Salmon River likely supported a small population of coho salmon in past years, perhaps a few thousand fish (California Department of Water Resources 1965 *op. cit.* CDFG 2004), although that number has likely dropped precipitously in the last two decades (Brown *et al.* 1994).

Some of the critical problems facing coho salmon within the Salmon River HU include barriers to fish passage, high sediment loads, limited riparian function, and unstable spawning gravel. To address sediment emanating from road surfaces, the USFS should work closely with federal, state, tribal and local cooperators to complete road sediment source inventories. Fish passage at each stream crossing should be analyzed as part of this process. These inventories should be used to prioritize future restoration funding throughout the basin. Large, catastrophic wildland fires have scarred large portions of the Salmon River landscape in past years and are responsible for areas of chronic hillslope failure and soil erosion that often feeds sediment directly into downslope stream channels (Elder *et al.* 2002). Since the extent of fire-related erosion is often positively correlated with fire severity (Robichaud 2000), Federal and private forest managers should work cooperatively to reduce understory fuel sources through controlled burns and brush clearing. Smaller, more frequent controlled burns closely mimic the historic fire regime of the basin, and will help prevent future catastrophic fires.

1. Lower Salmon River HSA

Fish passage into and out of Nordheimer Creek can be restricted during summer months by low flow and sediment aggradation at its confluence with the Salmon River. Restoration actions should focus on addressing the underlying causes of this phenomena, whether they are upslope sediment reduction or improving instream flow levels.

2. Wooley Creek HSA

Much of the Wooley Creek watershed lies within the Marble Mountain Wilderness Area, and salmonid habitat conditions remain largely unaffected by human influence.

3. Sawyers Bar HSA

The North Russian, South Russian, and Specimen Creek drainages suffer from increased soil erosion via the extensive road network within each drainage. Problem roads in these drainages should be upgraded or decommissioned where appropriate, and unstable slopes associated with these roads should be stabilized to prevent future mass-wasting and landslides. Sections of the North Fork Salmon River contain poorly functioning riparian corridors and are in need of restoration actions aimed at restoring native tree species (predominantly conifers and other deciduous types) that will help address low LWD levels in the future.

4. Cecilville HSA

The Cecilville HSA encompasses the South Fork Salmon River drainage, the largest of the four Salmon River HSAs. The South Fork Salmon River experienced intensive hydraulic mining during the late nineteenth and early twentieth centuries, and large tailing piles still exist adjacent to the mainstem river channel as a remnant byproduct of these activities. The tailing piles inhibit the establishment of functional riparian habitat throughout this reach, and combined with the east/west alignment of the South Fork channel, serve to increase solar input and ultimately instream water temperatures. In light of these factors, protecting and maintaining tributary water quality is critical within the upper Salmon River Basin.

C. Scott River and Shasta Valley HUs

The Shasta River watershed covers approximately 795 square miles, originating in the higher elevations of the Eddy Mountains, southwest of the town of Weed, in Siskiyou County, California (CDFG 2004). The river flows approximately 50 miles in a northerly direction, passing first through the Shasta Valley and then a steep-sided canyon before emptying into the Klamath River at rm 177. Seventy-two percent of the watershed is in private ownership. Access to the Shasta River and its tributaries is limited to a few miles of the lower Shasta River still in federal ownership, at public road crossings, and at locations where landowners provide access. The portion (approximately 3 rm) of the Shasta River that passes through Shasta Canyon is in BLM ownership. The BLM portion of the Shasta River is afforded protected status as an Area of Critical Environmental Concern.

The Scott River enters the Klamath River at rm 143 at an elevation of 1,580 feet (CDFG 2004). The watershed drains approximately 814 square miles and covers a large area with substantial variation in geology, geomorphology, and climate. Major tributaries to the 58-mile-long Scott River are Shackelford/Mill, Kidder, Etna, French, and Moffett Creeks, and the South and East Fork of the Scott River. The Klamath National Forest manages approximately 35 percent of the total Scott River watershed area, with the remaining 65 percent under other public management or private ownership. The mainstem river through Scott Valley is predominantly surrounded by

irrigated farmland (50 square miles) and range land (80 square miles) comprising 16 percent of the watershed.

The mainstem Scott and Shasta Rivers, and their low gradient tributaries favored by coho salmon, suffer many of the ailments common to drainages supporting extensive agricultural development. High summer diversion rates throughout both valleys limit mainstem and tributary flow levels, raise water temperatures, and lower water quality, making the mainstem Scott and Shasta Rivers unsuitable for rearing juvenile coho salmon. Particularly in the Scott drainage, groundwater pumping in areas where groudwater is hydrologically connected with a stream channel can further lower instream flows levels and limit riparian function and survival. Furthermore, earthen "push up" dams are still employed in some areas of the Scott Valley to divert streamflow for agriculture. These seasonal dams often block fish migration, and downstream reaches can go dry when diverters fail to release minimum bypass flows. To address these issues, restoration efforts should focus on working cooperatively with local ranchers to increase irrigation efficiency and water conservation through the implementation of "fish friendly" diversion structures and mandatory bypass flows. Incentives for local landowners with adjudicated water rights to forgo diverting during critical periods remains an important, yet currently not sufficiently funded, mechanism to establish coordinated water strategies in the Scott River and Shasta River.

Furthermore, high sediment loads resulting from upslope timber harvesting and road building in the Scott River watershed have simplified tributary rearing habitat, while sediment flushed from those tributaries often accumulates at tributary confluences, impairing mainstem-tributary connectivity. Implementation of the Scott River TMDL should provide guidance for restoration/management actions intended to limit sediment impacts within the basin. Finally, large, catastrophic fires have become more common throughout the Klamath River Basin due to past fire-management actions and the unchecked buildup of understory fuel. Since higher erosion and hillslope failure rates often result from catastrophic fires due to the intense heat and scorching of the forest floor, restoring a more natural fire regime within the basin through controlled burns and understory fuel removal projects is an important step in controlling post-fire erosion rates. It should be noted that both the Scott and Shasta Rivers have coho salmon populations that are dominated by one strong brood-year. The depressed nature of the two remaining brood-years compromises the long-term viability of the species within these two basins (CDFG 2004, Williams *et al.* 2006).

1. Scott Bar HSA

The Scott Bar HSA encompasses the lower canyon reach of the Scott River. Spawning and rearing habitat for coho salmon is limited in this reach, since many triburaries are high gradient, bedrock dominated systems ill suited for coho salmon spawning and rearing. Although the canyon reach is sparsely populated and does not suffer as much from the water quality/quantity impacts common to the upper Scott Valley, the surrounding hillsides do contain a large network of logging roads that can accelerate sediment routing into the lower Scott River. Restoration work should therefore focus on inventorying, prioritizing and ultimately fixing problem roads and culverts that exist within the HSA. Fish passage is also an issue within some of the larger tributaries that contain anadromous salmonid habitat, such as Tompkins Creek, Middle Creek

and Mill Creek (USDA 2000b). Creeks such as these that support anadromous salmonid production should have priority for limited restoration funding.

2. Scott Valley HSA

Agricultural water diversions (*i.e.,* surface diversions and groudwater pumping) and upslope road building are the primary mechanisms responsible for the degraded aquatic conditions within the Scott Valley HSA. As noted above, water quality throughout much of the mainstem Scott River and lower tributary habitat becomes unsuitable for coho salmon rearing following the beginning of irrigation season in late spring. Higher flows are needed to restore this habitat, and efforts to engage local ranchers in water conservation and other innovative solutions to dedicate more water to instream use are crucial to restoring coho salmon habitat. Although PCSRF has helped screen many diversion canals within the basin in the past several years, a few unscreened diversions remain. Similarly, riparian fencing projects have been popular within the Scott River watershed during past restoration funding cycles, but several unfenced tributary reaches still exist. Lower tributary habitat on the valley floor has been severely degraded through destruction of the riparian corridor and past channel re-alignment projects meant to ease water delivery to farms. Specifically, Big Mill Creek should be rerouted into its original channel to alleviate fish passage concerns that block coho salmon access to 1.25 miles of spawning and rearing habitat (USDA 1997). Tailings piles from past dredge mining in the Callahan area have altered the hydrologic and riparian function of the upper mainstem Scott River. The river flows subsurface during summer months through much of this reach.

3. Shasta Valley HSA

Poor water quality throughout the middle and lower Shasta River watershed severely limits juvenile coho salmon rearing success. Irrigation dams can back up river flow and create impoundments that increase solar input to the river and create habitat supporting non-native fish that prey on juvenile salmonids. Improperly-laddered dams can also impair upstream and downstream dispersal of juvenile coho salmon. To address this issue, restoration funding from CDFG is currently being utilized to remove several irrigation dams (*e.g.,* Aruja and Shasta Valley Water Users Association) along the mainstem Shasta River. Removing these dams should improve water quality conditions while restoring a more natural hydrologic regime. Incentive-based alternatives with willing participants should be investigated as a means of preserving water quality, quantity and coho salmon habitat in the Big Springs area of the upper Shasta River. Riparian habitat throughout much of the Shasta Valley has been degraded by uncontrolled cattle grazing adjacent to the mainstem Shasta River and tributaries, though recent riparian remediation through fencing projects and off-channel watering systems has improved conditions along key river reaches. Resources and incentives should be provided to landowners to protect all high-value stream reaches and restore riparian corridors where cattle grazing occurs adjacent to the river. Dwinnel Dam currently prevents coho salmon from utilizing high quality headwater habitat above the impounded reservoir, and also stores cool water that could benefit coho salmon residing in the mainstem Shasta River below the project (NAS 2004). The NRC suggested that removing Dwinnel Dam be considered as a potential action to help recover coho salmon populations in the Shasta River (NAS 2004).

D. Trinity River HU

The Trinity River is the largest tributary to the Klamath River, draining approximately 2,038 square miles in Humboldt and Trinity Counties (CDFG 2004). The headwater streams originate in the pristine wilderness of the Trinity Alps and Trinity Mountains located in eastern Trinity County. From its headwaters, the Trinity River flows 172 miles south and west through Trinity County, then north through Humboldt County and the Hoopa Valley and Yurok Indian Reservations until joining the Klamath River at Weitchpec, about 40 rm from the Pacific Ocean. Anadromous fish passage is blocked by Lewiston Dam, approximately 112 rm upstream from the mouth of the Trinity River. The construction of Lewiston and Trinity Dams blocked access to approximately 109 miles of salmon and steelhead habitat (USFWS/HVT 1999).

Most of the mainstem Trinity River watershed is in public ownership (predominantly USFS-managed land); only 24 percent of the watershed is in private ownership. Two Indian tribes, the Hoopa and Yurok, occupy reservation land within the Trinity River Basin. Both of theses tribes continue to rely on anadromous fish runs as they have since time immemorial, and much of their cultures are derived from resources found within the basin.

Large portions of the South Fork Trinity River watershed is publicly owned and managed by the Shasta-Trinity NF. Much of the basin is still recovering from impacts resulting from the large flood of 1964 that introduced massive volumes of sediment into the South Fork Trinity River and most tributary reaches. Due to the substantial sediment influx, much of the mainstem South Fork Trinity River and Hayfork Creek still lack deep pool holding habitat for adult salmon (USDA 1996, 2000c). Although sparsely populated in general, the basin does support some agriculture and grazing operations (primarily within the Hayfork Valley) that likely degrade water quality and riparian function (USDA 1998).

1. Lower Trinity HA

The lower Trinity HA spans the section of river between the North Fork Trinity River and the confluence with the Klamath River at Weitchpec and includes the following HSAs: Hoopa, Willow Creek, Burnt Ranch, New River and Helena. The lower Trinity River watershed is mostly federally-owned and managed by the USFS (Six Rivers and Shasta-Trinity NFs), except for sections below Tish Tang Creek (Hoopa Reservation) and small residential communities spread out along the river (*e.g.*, Willow Creek, Denny, *etc*.). Large wildland fires have impacted the watershed in the past several years, precipitating high hillslope erosion rates within affected tributary subwatersheds. Current fish population and habitat monitoring is carried out by CDFG, USFS and Hoopa Tribe scientists.

a. Hoopa HSA

The Hoopa HSA extends from the confluence of the Trinity and Klamath Rivers upstream to Willow Creek. The lower third of the HSA winds through a deep bedrock canyon which offers little spawning and rearing opportunity for coho salmon. Just upstream of the canyon reach lies the Hoopa Valley, which contains several productive coho salmon tributaries, such as Mill Creek, Tish Tang Creek, and Supply Creek. Horse Linto Creek, perhaps the most productive

anadromous salmonid stream in the HSA, enters the mainstem Trinity River just south of the Hoopa reservation boundary. Intensive road development has increased erosion rates and sediment delivery into streams within the Hoopa Reservation, whereas the Horse Linto Creek watershed lies entirely within USFS boudaries and comparably has a lower road density. Restoration actions within the Hoopa HSA should be primarily focused on containing erosion and hillslides resulting from the Megram Fire, which occurred in 1999 and burned large portions of the Mill, Tish Tang, and Horse Linto watersheds (~125,000 acres total, USDA 2000a). The greatest erosion threats exist in the Horse Linto Watershed, since more acres of high and moderate burn severity are located on steep, erodible slopes in that watershed. Restoration funding should first focus on stabilizing exposed slopes within the three drainages that have the highest potential for hillslope failure. Rehabilitating damaged riparian habitat will also help minimize hydrologic connectivity between upslope sediment sources and the stream environment. LWD loading rates will also likely be impacted by the fire, and should be evaluated as a potential management concern.

b. Willow Creek HSA

Highway 299 parallels much of mainstem Willow Creek as the highway climbs from the town of Willow Creek over Berry Summit and into the Redwood Creek watershed. Many of the restoration needs within the HSA derive from impacts attributed to Highway 299 and other roads within the watershed, such as decreased riparian function, low LWD recruitment, and increased upslope erosion (USDA 2003a). LWD and instream habitat surveys should be conducted to identify appropriate, high-value restoration projects. Upslope sediment sources and fish passage impediment occurring on private land within the watershed should be inventoried and treated.

c. Burnt Ranch HSA

The Burnt Ranch HSA covers a large portion of the middle Trinity River Basin, extending from the confluence of the South Fork Trinity River upstream to the North Fork Trinity River confluence (excluding the New River, the largest tributary of the reach). Much of the mainstem river within this HSA is deeply incised and confined by bedrock banks, with many of the smaller tributaries exhibiting steep gradients that preclude coho salmon usage. Thus, coho salmon spawning and rearing habitat is generally lacking in the Burnt Ranch HSA except for portions of Big French and Manzanita Creeks (Everest 2007). Road densities are typically low within the two creeks, except for steep headwater areas that occur outside accessible anadromous reaches. Instream sediment levels are highest within Sailor Bar and Big Bar Creeks. Where excessive sediment aggradation has occurred at tributary confluences, low flows can limit mainstem-tributary connectivity during the summer and fall periods. Restoration efforts should focus on addressing instream sediment levels through road remediation and hillslope stabilization where necessary.

d. New River HSA

The 123,000-acre New River watershed is almost entirely under public ownership, with approximately 78,000 acres of designated wilderness area. Anthropogenic impacts are few within the basin due to the wilderness designation, so robust instream habitat conditions support

healthy anadromous salmonid populations, mainly Chinook salmon and steelhead. Unfortunately, low-gradient tributary habitat is scarce, so coho salmon are uncommon within the basin. The 1999 Big Bar Complex fire affected a large portion of the upper watershed; landslides and hillslope erosion from fire-scarred hillsides will be the predominant source of sediment entering the system in the future (USDA 2000d). However, the increased sediment influx is not expected to appreciably change instream flow timing, turbidity, or temperature regimes. Management actions should continue to focus on rehabilitating riparian habitat and unstable upslope areas damaged by the Big Bar Complex fire.

e. Helena HSA

North Fork Trinity River and Canyon Creek are the two dominant watersheds within the Helena HSA, and also contain much of the available anadromous salmonid habitat. Because these stream drainages flow out of the steep Trinity Alps Wilderness Area, existing stream gradients are often too steep to support high quality spawning and rearing conditions for coho salmon. Only the East Fork of the North Fork Trinity River likely supports a moderate level of coho salmon production (USDA 2003b). Management recommendations should focus on restoring channel degradation in Canyon Creek caused by past mining activities in order to re-establish riparian function and bank stability.

2. Middle Trinity HA

The Douglas City and Weaver Creek HSAs encompass the upper anadromous reaches of the Trinity River watershed, spanning from Lewiston Dam downstream to Browns Creek. Several watersheds within these two HSAs support moderate populations of coho salmon, including Weaver Creek, Rush Creek, Browns Creek, Little Browns Creek, and Indian Creek. Most of these subwatersheds are privately owned except for the headwater reaches of Weaver Creek and Indian Creek, which lie within USFS boundaries. In general, water quality is often good within the Middle Trinity River reach since most creeks are fed from high elevation snow melt from the Trinity Alps and surrounding mountains. However, water diversions from Weaver, Rush, Reading, Indian and Browns Creeks diminish instream flows and water quality during summer months (USDA 2004). The effect of these water diversions on coho salmon habitat should be investigated and, where necessary, diversion screens meeting CDFG/NMFS juvenile and adult screening guidelines should be installed. Riparian function is compromised in many tributary within the Middle Trinity River watershed. Incentives and resources should be provided to willing landowners to reduce riparian impacts from agricultural and grazing practices. Erosion and sediment delivery mechanisms should also be addressed, since many tributaries suffer from simplified instream habitat conditions due to high sediment levels.

3. South Fork Trinity HA

The South Fork Trinity River watershed spans 932 square miles within Humboldt and Trinity Counties. Hayfork Creek is the largest subwatershed in the South Fork Trinity River drainage. As stated in an earlier section, much of the South Fork Trinity River is impaired by high instream sediment loads related to both high road densities and chronic mass-wasting initiated by the catastrophic 1964 flood. Excessive water diversion has been documented within the Hayfork

Creek watershed and should be investigated. Where legal water rights are being exercised, cooperative agreements with landowners should be explored to dedicate more water to instream use.

a. Grouse Creek HSA and Forest Glen HSA

Intensive logging and road building have occurred within the Grouse Creek watershed since the 1940s, and approximately 40 percent of the watershed had been harvested by 1970 (U. S. Environmental Protection Agency (EPA) 1998). Since the western portion of the South Fork Trinity River watershed is underlain by highly erosive geology, erosion rates are disproportionally large within the Grouse Creek watershed compared to other sub-watersheds. Opportunities exist within the Grouse Creek watershed to stabilize unstable upslope areas, enhance existing riparian habitat, and storm proof or decommission problem road segments. The Forest Glen HSA spans the upper South Fork Trinity River watershed upstream of Hayfork Creek, and suffers from many of the same stressors as the lower watershed (USDA 1999b). Chronic sediment introduction from roads in the Rattlesnake Creek and Plummer Creek watersheds should be addressed through hillslope stabilization projects and road decommissioning work. Riparian restoration projects are needed to improve riparian function and help lower instream water temperatures during summer months.

b. Hyampom HSA

The Hyampom HSA includes the South Fork of the Trinity River and its tributaries from Eltapom Creek upstream to Hayfork Creek. Historical data show that the South Fork Trinity River and its larger tributaries were once important spawning grounds for coho salmon. The frequency and size of coho salmon runs in the South Fork Trinity River are not well documented, though they have been reported to migrate as far upstream as Hyampom (CDFG 2004). Since it represents one of the few alluvial reaches throughout the mainstem South Fork Trinity River, the Hyampom Valley is a natural spot for sediment aggradation from upstream sources and has been slow to recover from the effects of the 1964 flood. To address the high erosion rates in the area, the USFS should develop a management plan for the Big Slide to reduce sediment mobilization and investigate moving the county road that crosses the Big Slide. Fuel reduction projects will help minimize the future occurrence of large, catastrophic wildland fires.

c. Hayfork Valley HSA and Corral Creek HSA

The Hayfork Creek watershed suffers from low flows, high instream sediment concentrations, and poor instream habitat complexity (USDA 1998, 2000c). Farming within the low gradient Hayfork Valley diverts large volumes of water from mainstem Hayfork Creek and the valley portion of some tributaries, severely restricting instream flow levels and compromising water quality. Innovative solutions stressing water conservation and the purchase of available water rights should be explored with willing landowners. Similarly, Trinity County should amend its Critical Water Resources Overlay Zone to address new water right developments that are arising from the subdivision of existing land parcels. Restoration and protection projects are necessary to improve dysfunctional riparian habitat. Finally, fuel reduction projects will minimize the chance of future high intensity, catastrophic fires and help facilitate a more natural fire regime to

the area. Research has demonstrated that erosion and hillslope wasting processes are much less severe following small, low intensity wildland fires (Robichaud 2000).

VII. CONCLUSIONS

Built on the foundation of the extensive work already accomplished, NMFS has relied heavily on the existing recovery strategies developed by CDFG (2004) for coho salmon using substantial local stakeholder participation to develop this MSRA Recovery Plan. Our overview of coho salmon life history information available for the Klamath River Basin in Section III found that typical of large river systems, adult coho salmon have a broad period of freshwater entry in the Klamath River and juvenile coho salmon have a strong tendency to redistribute within the Klamath River Basin due to seasonal changes in conditions. Although information on coho salmon population trends in the Klamath River Basin remains incomplete, the available data suggest that coho salmon stock abundance remains at low levels and depressed, with one coho salmon brood year class considerably stronger than the other two brood year classes.

As described in Section V, a variety of important conservation programs and management actions are underway to improve water quality and quantity and restore habitat in the Klamath River Basin. Many actions have been completed, others are in the process of implementation, and still others are in the developmental stage. Native American tribes have worked for many years to improve land-use practices and fisheries practices, and have implemented salmon monitoring, research and habitat restoration programs while striving to maintain their native cultural, economic, and spiritual values associated with Klamath River aquatic resources. The RCDs are currently working at the local level to develop programs to improve irrigation practices and irrigation water use to reduce effects to aquatic habitat in important coho salmon spawning and rearing tributaries in the Klamath River Basin while maintaining sustainable agricultural practices. Commercial and recreational fishing for coho salmon in California ocean waters and rivers ceased a decade ago when abundance plummeted. Past and future wetland and habitat restoration programs in the upper Klamath River Basin will improve water quality and provide more flexibility for water management.

Still, more needs to be accomplished to recover coho salmon in the Klamath River Basin. Section VI's synopsis of specific threats and recommended restoration actions highlight high priority areas and actions. Progress to provide necessary resources and incentives both to improve forestry practices, agricultural practices, remove artificial barriers, and curb potential habitat threats from urbanization in the Klamath River Basin is necessary to improve the viablity of coho salmon populations in the Klamath River Basin. Moreover, fish disease mechanisms are poorly understood in the Klamath River Basin. Although researchers suspect that low flows and modifications of the historic hydrologic regime, combined with poor water quality conditions, have created instream conditions that favor disease proliferation and fish infection, to what extent disease impacts coho salmon population viablity is unknown. Despite the economic and cultural value of robust and healthy Klamath salmon populations, few sources of reliable funding for fish health studies are available. Funding for multi-year disease studies in the Klamath River Basin remains a critical resource need to allow more scientifically-supportable management decisions and enable effective habitat restoration actions.

For decades, a wide variety of public and private entities have been active in the Klamath River Basin collaborating and coordinating on a wide-array of important and useful research, monitoring and restoration actions. Despite the need for a Basin-wide centralizing tool or instrument to guide and collaboratively coordinate and prioritize monitoring, restoration and research efforts, no such tool exists. Such a tool could optimize benefits from existing efforts and resources, identifying gaps in current programs, prioritize activities that fill those gaps, identify funding opportunities and partners, and illustrate how monitoring, research and restoration efforts fit together in the Basin as a whole.

This MSRA Recovery Plan should serve as a valuable tool for NMFS development of its SONCC coho salmon recovery plan under the ESA. For instance, the MSRA Recovery Plan summarizes ongoing threats affecting Klamath River coho salmon and current conservation efforts throughout the Klamath River Basin, as well as provides up-to-date scientific information on coho salmon status and trends. The list of "top priority" actions below should help prioritize implementation of critical coho recovery actions in the Klamath River Basin.

Recovery plans developed under the ESA serve as a "road map to recovery," and, therefore, are an important tool for promoting sound scientific and logical decision-making throughout the recovery process. While no agency or entity is required by the ESA to implement specific actions in a recovery plan, the ESA clearly envisions recovery plans as the central organizing tool for guiding each species recovery process. Recovery plans also provide context and a framework for implementation of section 7(a)(1) and (2), section 10, and section 4(d) of the ESA and serve as outreach tools by helping interested parties understand the rationale behind the recovery actions identified and how they can facilitate species recovery.

As described in more detail in Section VI, efforts have been underway for several years to develop the ESA SONCC coho salmon recovery plan. NMFS recognizes that California has recently undertaken extensive conservation and recovery planning efforts for coho salmon in collaboration with a variety of stakeholders, including NMFS. Similarly, Oregon has also developed coho salmon conservation planning strategies. NMFS' development of the SONCC coho salmon federal ESA recovery plan will recognize, consider and utilize, to the maximum extent possible, California and Oregon's coho salmon conservation plans. NMFS is in the process of developing additional analyses to supplement information developed by the states. For instance, fundamental to the SONCC coho salmon recovery plan developed under the ESA is a comprehensive "threats assessment". The SONCC coho salmon threats assessment will be an extensive compilation and synthesis of existing data, and will include input and technical review from an array of individuals that have knowledge of the species and conditions it faces. This threats assessment will identify key limiting factors to the various life history phases of coho salmon across the range of SONCC coho salmon, including populations within the Klamath River Basin. The threats assessment, in conjunction with the population viability criteria and integrated with conservation and management actions underway, will facilitate the development of focused and prioritized recovery actions for SONCC coho salmon. NMFS will also develop specific delisting criteria and recovery goals for integration into the federal ESA SONCC coho salmon recovery plan. Although the estimated cost of recovering Klamath River coho salmon is approximately $1.785 billion according to CDFG's Coho Salmon Recovery Strategy (CDFG 2004), the actual cost will likely be higher since anticipated water purchases outside of the

Shasta/Scott basins were not included in the CDFG estimate. A cost estimate from the ESA recovery planning effort has not yet been derived.

NMFS is working with tribes, local governments and other entities, and will conduct substantial public outreach as we prepare the draft and final ESA recovery plan for SONCC coho salmon. NMFS is currently working with various co-managers in both Oregon and California and will hold public meetings to solicit review and comment on its limiting factors analysis in August 2007. NMFS expects to make the draft SONCC coho salmon recovery plan developed under the ESA available to the public for comment by spring 2008.

A. High Priority Recovery Actions

Appendix II presents the recommended restoration actions and rankings from CDFG's recovery strategey (CDFG 2004) for coho populations within the Klamath River Basin. In addition, based on the review of information presented in this MSRA Recovery Plan, NMFS has identified below the high priority strategic actions that are necessary for coho salmon recovery in the Klamath River Basin. The order of presentation in this list provides a preliminary indication of the significance of each action in its potential contribution to coho salmon recovery. The order in which these actions are taken and the methods that will be applied will be refined in the ESA SONCC coho salmon recovery plan that will address the broader ESU of which coho salmon populations in the Klamath River Basin are a part.

A. Complete and implement the NMFS recovery plan for the SONCC coho salmon under the ESA.

B. Restore access for coho salmon to the upper Klamath River Basin by providing passage beyond existing mainstem dams.

C. Implement fully the Trinity River Restoration Program.

D. Provide incentives for private landowners and water users to cooperate in: (1) restoring access to tributary streams that are important for coho spawning and rearing; and (2) enhancing mainstem and tributary flows to improve instream habitat conditions.

E. Continue to improve the protective measures already in place to address forestry practices and road building/maintenance activities that compromise the quality of coho salmon habitat.

F. Implement restorative measures identified through fish disease research results to improve the health of Klamath River coho salmon populations.

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IX. APPENDIX I: THREATS TABLE ORGANIZED AT THE HSA LEVEL.

Hydrologic Area	Lower Klamath River			Middle Klamath River					Salmon River				Scott River		Shasta Valley	Lower Trinity River						Middle Trinity River		South Fork Trinity River				
Hydrologic Sub-Area	Klamath Glen	Orleans	Ukonom	Happy Camp	Seiad Valley	Beaver Creek	Hornbrook	Iron Gate	Lower Salmon	Wooley Creek	Sawyers Bar	Ceciliville	Scott Bar	Scott Valley	Shasta Valley	Hoopa	Willow Creek	Burnt Ranch	New River	Helena	Douglass City	Weaver Creek	Grouse Creek	Hyampom	Forest Glen	Corral Creek	Hayfork Valley
Degraded Habitat-Estuarine and Nearshore Marine	x																										
Degraded Habitat-Floodplain Connectivity and Function	x												0														
Degraded Habitat-Channel Structure and Complexity	x	x		0		0					x	x		x		0	x			0		0		x	0		x
Degraded Habitat-Riparian Areas and LWD Recruitment	x	x	x	x	x	x								x	x	0	x		0	0	x	0			0	0	0
Degraded Habitat-Stream Substrate	x	x	x	0		x	x	x	x		x	x		x	x	0	x	‡	0		x	0	x	x	0		x
Degraded Habitat-Stream Flow		x				0	x	x					0	x	x									x		0	x
Degraded Habitat - Water Quality		x	x	x	x	0			0		0	x	0	x	x	0							x		0	0	x
Degraded Habitat - Fish Passage		x	x	x	x		x	x	0				0	x	x						x		x	x	0		x
Hatchery-related Adverse Effects	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ								Δ	Δ	Δ	Δ	Δ	Δ	Δ					
Harvest-related Adverse Effects		x													x												
Predation/Competition/ Disease	†	†	†	†	†	†	†	†																			

Symbol Code: x = CDFG Coho Recovery Strategy (CDFG 2004); 0 = various USFS watershed analyses; Δ = Joint CDFG/NMFS Hatchery Review (CDFG and NMFS 2001) and SONCC coho salmon status review (Good *et al*. 2005); † = NAS Report (NAS 2004); ‡ = Everett 2007.

X. APPENDIX II: CDFG'S IMPLEMENTATION SCHEDULE FOR KLAMATH WATERSHED RECOMMENDATIONS.

CDFG's Implementation Schedule for Klamath Watershed Recommendations (as appears in CDFG 2004), organized by watershed priority, task level, action entities, and estimated duration. Watershed priority ranges from 1 (lowest priority) to 5 (highest), and represents the watershed's restoration and management potential. Task levels denote the relative importance or priority for implementation, and range from C (lowest) to E (highest). Task level E symbolizes recommendations critical to coho salmon recovery that must be implemented rapidly, while level C tasks contribute to stated recovery goals or criteria (or will likely result in delayed recovery if not implemented).

IMPLEMENTATION SCHEDULE FOR KLAMATH RIVER BASIN

HSA PRIORITY	TASK LEVEL	TASK NUMBER	TASK DESCRIPTION	IDENTIFIED ACTION ENTITIES	ESTIMATED DURATION
KLAMATH RIVER HU					
	E	KR-HU-01	Facilitate development of a cooperative adaptive management plan in preparation for low-flow emergencies.	POTENTIAL LEAD: CDFG, PacifiCorp OTHERS: USBR, NOAA Fisheries, USFWS, DOI, Tribes, SWQCB, other stakeholders	Interim
	E	KR-HU-02	Develop a plan to restore and maintain tributary and mainstem habitat connectivity where low flow or sediment aggradation is restricting coho salmon passage.	POTENTIAL LEAD: CDFG OTHERS: RWQCB, NOAA Fisheries, USFS, Yurok Tribe, CDF, Caltrans, Private Landowners	Interim
	C	KR-HU-03	Develop a plan (including a feasibility analysis) for coho salmon passage over and above Iron Gate and Copco dams to restore access to historic habitat.	POTENTIAL LEAD: FERC, PacifiCorp OTHERS: USFWS, USBR, NOAA Fisheries, CDFG	Interim
	C	KR-HU-04	Analyze the feasibility and appropriateness of site-specific FGC §2084 permits for sport fishing for hatchery coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries	Interim
	E	KR-HU-05	Complete comprehensive flow study activities (e.g. Hardy Phase II) and use them to educate water managers on how to reduce impacts to coho salmon.	POTENTIAL LEAD: BIA, USFWS OTHERS: NOAA Fisheries, CDFG	Interim

	D	KR-HU-06	Implement the comprehensive flow study in a manner that will restore natural stream processes	POTENTIAL LEAD: USBR OTHERS: USFWS, NOAA Fisheries, CDFG	Interim
	E	KR-HU-07	Apply protective down-ramp rates at Iron Gate Dam to minimize stranding of coho salmon fry.	POTENTIAL LEAD: CDFG, USBR, FERC, PacifiCorp OTHERS: USFWS	Interim
	E	KR-HU-08	Improve water quality coming into the Klamath River mainstem from the Upper Klamath River Basin through ongoing efforts.	POTENTIAL LEAD: CDFG OTHERS: USBR, USFWS, NOAA Fisheries	Interim/ Ongoing
	D	KR-HU-09	Perform cost/benefit analysis of full or partial Hydroelectric Project removal for the purposes of improving water quality, fish passage, and sediment transport.	POTENTIAL LEAD: PacifiCorp, FERC OTHERS: USBR, USFWS, NOAA Fisheries, CDFG	Interim
	D	KR-HU-10	Manage the streams and uplands in key cold-water tributaries, to preserve their cold-water thermal regime.	POTENTIAL LEAD: USFS OTHERS: Tribes, NOAA Fisheries, USFWS, CDFG, Landowners, Counties, Watershed Groups	Interim/ Continual
	D	KR-HU-11	Investigate coho salmon non-natal rearing and refugia use in lower reaches of tributaries and mainstem confluences.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFWS	Interim
	D	KR-HU-12	Protect and enhance tributary reaches identified as providing refugia to juvenile coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFWS	Interim
	E	KR-HU-13	Develop a plan to address water quality and quantity in Klamath River tributaries that exacerbate mainstem water quality problems.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Private Landowners	Interim/ Ongoing
	D	KR-HU-14	Implement the plan that addresses water quality and quantity in the Klamath River tributaries that exacerbate mainstem water quality problems.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Private Landowners	Interim/ Ongoing
	E	KR-HU-15	Assess hatchery operations in terms of coho salmon recovery in accordance with the policies and guidelines included in this document.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFWS, USBR	Interim
	E	KR-HU-16	Continue disease monitoring of juvenile salmon emigration in the Klamath River mainstem so that major disease outbreaks can be identified and their causes evaluated.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFWS	Interim/ Ongoing

	E	KR-HU-17	Conduct disease monitoring of migrating adult Chinook and coho salmon during fall migration.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFWS, USBR	Interim/ Continual
	D	KR-HU-18	Conduct studies in and around the Klamath River Hydroelectric Project to see if the Project is contributing to habitat for the *Ceratomyxosis* intermediate host.	POTENTIAL LEAD: PacifiCorp OTHERS: USBR, CDFG, NOAA Fisheries, USFWS	Interim
	C	KR-HU-19	Restore appropriate coarse sediment supply and transport near Iron Gate Dam. Means to achieve this could include full or partial removal of the Klamath Project, or gravel introduction such as is done below other major dams (e.g., Trinity Dam).	POTENTIAL LEAD: FERC, PacifiCorp OTHERS: USFWS, NOAA Fisheries, CDFG	Long-term
	E	KR-HU-20	Acquire additional water through conservation easements and purchases of water and water rights from willing sellers, where lack of flows is a limiting factors and dedicate these flows to instream coho salmon needs	POTENTIAL LEAD: CDFG OTHERS: USBR, NOAA Fisheries, USFWS	Long-term/ Continual
	E	KR-HU-21	Acquire interim, emergency water through transfers of water and water rights from willing sellers, when necessary to meet critical instream coho salmon needs.	POTENTIAL LEAD: CDFG OTHERS: USBR, NOAA Fisheries, USFWS	Interim
	D	KR-HU-22	Provide watermaster service for all diversions with partial funding provided by the state or federal governments.	POTENTIAL LEAD: DWR OTHERS: SWRCB, CDFG, USBR	Interim/ Continual
	C	KR-HU-23	Promote public interest in the Klamath River Basin's coho salmon, their beneficial use and habitat requirements.	POTENTIAL LEAD: CDFG OTHERS: USFWS, RCDs, Watershed Groups	Interim/ Continual
KLAMATH GLEN HSA					
5	E	KR-KG-01	Resume estuary investigations to better understand the estuary's role in the survival of Klamath River Basin River coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, Yurok Tribe, Coastal Commission, NPS	Interim/ Ongoing

5	D	KR-KG-02	Develop a plan to restore off-channel estuarine, wetland, and slough habitat in the Klamath River estuary and adjoining lower tributary reaches that includes: a. Determining if key properties, conservation easements, or development rights need to be purchased and the work with wiling landowners; and b. Determining the need and installation of livestock exclusion fencing to protect restored areas.	POTENTIAL LEAD: CDFG OTHERS: Yurok Tribe, Private Landowners	Interim
5	D	KR-KG-03	Implement the plan to restore off-channel estuarine, wetland, and slough habitat in the Klamath River estuary and adjoining lower tributary reaches	POTENTIAL LEAD: CDFG OTHERS: Yurok Tribe, Private Landowners	Interim
5	D	KR-KG-04	Develop a plan to maintain Blue Creek watershed tributaries as key thermal refugia for their cool water contributions to the mainstem Klamath River. The plan should emphasize that: a. Sediments from upslope activities do not impact the refugia; b. Upslope stabilization and restoration activities continue, including road assessment and treatment; c. In-channel and riparian restoration efforts (target riparian retention efforts) continue; and d. Feral cattle are removed.	POTENTIAL LEAD: Yurok Tribe OTHERS: Simpson, USFS, NOAA Fisheries, CDFG, USFWS	Interim/ Ongoing
5	D	KR-KG-05	Implement the plan to maintain Blue creek watershed tributaries as key thermal refugia for their cool water contributions to the mainstem Klamath River.	POTENTIAL LEAD: Yurok Tribe, Simpson OTHERS: USFS, CDFG, CCC, SCC	Interim/ Ongoing
5	D	KR-KG-06	Develop a plan to protect and restore Klamath River mainstem tributaries, even those that do not support populations of coho salmon but that provide cool water and which improve mainstem Klamath water quality, particularly during warm summer months. Plan should emphasize the: a. Protection and/or restoration of riparian habitat; b. Stabilization of upslope areas to prevent sedimentation and aggradation of tributaries at their mouths; and c. Improvement of federal land management activities to reduce impacts to riparian corridors and decrease sediment loads. d. Finalize and/or refine the Lower Klamath Sub-Basin Watershed Restoration Plan (Gale and Randolph 2000) that focuses on the tributaries to the Lower Klamath within the Klamath Glen HSA.	POTENTIAL LEAD: Yurok Tribe OTHERS: Simpson, USFS, NOAA Fisheries, RWQCB, Yurok Tribe, Hoopa Valley Tribe, USFWS	Interim/ Ongoing
5	D	KR-KG-07	Finalize and Implement the Lower Klamath Sub-Basin Watershed Restoration Plan (Gale and Randolph 2000) to protect and restore Klamath River mainstem tributaries.	POTENTIAL LEAD: Yurok Tribe, Simpson OTHERS: USFS, CDFG, CCC, SCC	Interim/ Ongoing

5	D	KR-KG-08	Reduce sediment input from upslope sources, including activities such as: a. Decommissioning skidtrails and unmaintained roads, where possible; b. Upgrading roads and maintenance practices; c. Stabilizing slopes to minimize or prevent erosion and to minimize future risk of eroded material entering streams, and d. Minimizing alteration of natural hillslope drainage patterns.	POTENTIAL LEAD: Yurok Tribe, Simpson OTHERS: USFS, CDFG, CCC, SCC	Interim/ Ongoing
5	E	KR-KG-09	Review existing inventory and assessment of barriers (Gale 2003) and prioritize barriers impeding migration of adult and juvenile coho salmon throughout the Lower Klamath River tributaries.	POTENTIAL LEAD: Yurok Tribe OTHERS: Simpson, Del NorteCounty, Caltrans, CDFG, CCC, SCC	Interim/ Ongoing
5	D	KR-KG-10	Treat prioritized barriers impeding migration of adult and juvenile coho salmon throughout the Lower Klamath River tributaries.	POTENTIAL LEAD: CDFG OTHERS: County, Tribes, NOAA Fisheries, USFWS, Landowners, Caltrans	Interim/ Ongoing
5	D	KR-KG-11	Investigate temporal and spatial magnitude of tributary deltas and seasonal subsurface flow reaches to determine impacts to juvenile and adult coho migration and to quantify seasonal loss of lower tributary habitat. Investigation should include assessment of long-term delta size trends, annual variation in coho salmon access periodicity by tributary, quantification of seasonal habitat loss and fish stranding, and the relation of delta and subsurface flow formation to upslope erosion, river and tributary flow, mainstem bedload deposition and other causative factors.	POTENTIAL LEAD: Yurok Tribe OTHERS: Simpson, CDFG, CCC	Long-term
5	D	KR-KG-12	Conduct feasibility study to reestablish adult coho salmon passage above major barriers in lower Roaches and Tully creeks and the Middle and North Forks of Ah Pah Creek.	POTENTIAL LEAD: CDFG, Yurok Tribe OTHERS: Simpson, CCC, NOAA Fisheries	Interim
5	D	KR-KG-13	Treat sediment sources and improve riparian and instream habitat conditions to provide adequate and stable spawning and rearing areas for coho salmon.	POTENTIAL LEAD: Yurok Tribe, Simpson, CCC OTHERS: USFS, CDFG, SCC	Interim/ Ongoing
5	D	KR-KG-14	Develop a plan to restore in-channel and riparian habitat in tributaries to address: a. Revegetating riparian zones with native species (e.g., conifers) to stabilize stream banks and promote a long-term supply of LWD; b. Providing adequate protection from development, grazing, etc; and c. Relocating roads out of riparian areas when feasible.	POTENTIAL LEAD: Yurok Tribe, CDFG OTHERS: Landowners, CCC, CDF, SCC, NOAA Fisheries	Interim/ Continual

5	D	KR-KG-15	Implement the plan to restore in-channel and riparian habitat in tributaries.	POTENTIAL LEAD: Yurok Tribe, Simpson, CCC OTHERS: NOAA Fisheries, CDFG, CDF, SCC, Landowners	Interim/ Continual
5	D	KR-KG-16	Develop a plan to provide suitable accumulations of woody cover in slow-velocity habitats for coho salmon winter rearing on a short-term basis by placing wood in needed areas until natural supplies become available.	POTENTIAL LEAD: CDFG OTHERS: Tribes, Landowners, USFS	Interim
5	D	KR-KG-17	Implement the plan to provide suitable accumulations of woody cover in slow-velocity habitats for coho salmon winter rearing on a short-term basis by placing wood in needed areas until natural supplies become available.	POTENTIAL LEAD: CDFG OTHERS: Tribes, Landowners, USFS	Interim
5	C	KR-KG-18	Construct livestock exclusionary fencing and corresponding riparian restoration as necessary in Salt, lower High Prairie, lower Hunter and lower Terwer creeks. Provide funding and incentives to landowners and/or restoration groups where necessary to achieve this goal.	POTENTIAL LEAD: CCC, Yurok Tribe OTHERS: Landowners, CDFG	Interim
5	C	KR-KG-19	Develop a plan to remove feral cattle from lower Blue and Bear Creeks.	POTENTIAL LEAD: Yurok Tribe OTHERS: Simpson	Interim
5	C	KR-KG-20	Implement the plan to remove feral cattle from lower Blue and Bear creeks.	POTENTIAL LEAD: Landowners	Interim/ Continual
5	D	KR-KG-21	Work with Humboldt County, NOAA Fisheries and existing and future gravel-mining operators to restrict gravel-mining operations to appropriate mainstem Klamath locations. Gravel mining should not be conducted within Lower Klamath tributary watersheds until a scientifically valid and peer-reviewed geomorphic analysis is conducted to determine existing channel stability, causes of excess aggradation, and identifies gravel mining as an appropriate restorative measure, as outlined in task RW-XXXV-A-1.	POTENTIAL LEAD: CDFG OTHERS: County, NOAA Fisheries, existing and future gravel mining operators	Interim/ Continual
5	C	KR-KG-22	Encourage cooperation between industrial timber land managers and tribes to restore coho salmon habitat Use the successful Tribal/Simpson Resource Company program as an example.	POTENTIAL LEAD: CDFG OTHERS: Tribes, Simpson Timber	Interim

5	D	KR-KG-23	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; c. Improvement of existing riparian zones through planting and release of conifers, and control of alders, blackberries, and other competitors; and d. Provide technical support as an incentive for landowners.	POTENTIAL LEAD: CDFG OTHERS: USFS, NOAA Fisheries, Yurok Tribe, CDF, Landowners	Interim/ Ongoing
5	D	KR-KG-24	Provide technical and financial support to implement riparian restoration throughout alluvial reaches in lower Blue, Terwer, Hunter and Salt creeks.	POTENTIAL LEAD: CDFG OTHERS: Landowners, CCC, Yurok Tribe	Interim/ Continual
5	C	KR-KG-25	Investigate straying and impacts of exotic fish (bass and bullhead) populations in an abandoned mill pond in lower Richardson Creek to coho salmon in the adjoining Klamath River estuary.	POTENTIAL LEAD: CDFG OTHERS: Yurok Tribe, RNSP, NOAA Fisheries	Interim/ Continual
5	C	KR-KG-26	Continue funding and technical support for the California Conservation Corps to continue their collaborative participation with the Yurok Tribe and Simpson Resource Company to implement watershed restoration throughout the lower Klamath River subbasin.	POTENTIAL LEAD: CDFG OTHERS: Yurok Tribe, Simpson Resource Company	Interim/ Ongoing
5	E	KR-KG-27	Support continued implementation of the Coho Salmon Regional Abundance Inventory throughout the lower Klamath River subbasin.	POTENTIAL LEAD: CDFG OTHERS:	Interim/ Ongoing
5	C	KR-KG-28	Develop a plan to restore the historic flood plain on Hoppaw Creek, in cooperation with landowners and Caltrans.	POTENTIAL LEAD: CDFG OTHERS: Simpson, Yurok Tribe, Caltrans	Interim
5	C	KR-KG-29	Implement the plan to restore the historic flood plain on Hoppaw Creek.	POTENTIAL LEAD: CDFG OTHERS: Landowners, Caltrans	Interim

ORLEANS HSA					
3	D	KR-OR-01	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon that provide cool water and which improve mainstem Klamath River water quality and which provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Include improved land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request SWRCB to review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
3	D	KR-OR-02	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, but which provide cool water and which improve mainstem Klamath River water quality and/or provide thermal refugia for coho salmon, particularly during warm summer months.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
3	D	KR-OR-03	Continue activities that maintain connectivity (flow) between mainstem habitat and tributary habitat in Slate and Red Cap creeks.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG	Interim/ Continual
3	C	KR-OR-04	Develop a plan to protect and enhance spawning and rearing habitats in Boise and Camp creeks.	POTENTIAL LEAD: USFS	Interim
3	C	KR-OR-05	Implement the plan to protect and enhance spawning and rearing habitats in Boise and Camp creeks.	POTENTIAL LEAD: USFS	Interim
3	E	KR-OR-06	Develop a plan to protect and enhance Bluff and Red Cap creek watersheds, which are classified as Key Watersheds in the Northwest Forest Plan, and are refugia for coho salmon.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, LEAD: CDFG	Interim/ Ongoing
3	D	KR-OR-07	Implement the plan to protect and enhance Bluff and Red Cap creek watersheds	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG	Interim/ Ongoing
3	C	KR-OR-08	Reestablish natural fire regimes consistent with the Northwest Forest Plan to reduce the risk and impact of large, severe fire on coho salmon.	POTENTIAL LEAD: USFS, BLM OTHERS: CDF, Landowners	Interim

3	C	KR-OR-09	Support efforts to provide livestock exclusion fencing where feasible and appropriate, while providing off-site watering.	POTENTIAL LEAD: USFS OTHERS: Landowners	Interim/ Ongoing
3	D	KR-OR-10	Reduce sediment input from upslope sources, including measures to: a. Decommission skid trails and unmaintained roads where possible; b. Upgrade roads and maintenance practices, c. Stabilize slopes to minimize or prevent erosion and to minimize future risk of eroded material entering streams, and d. Minimize alteration of natural hillslope drainage patterns.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
UKONOM HSA					
3	D	KR-UK-01	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon, but which provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Include improved land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request that SWRCB review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	Potential Lead: USFS Others: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim/ Ongoing
3	D	KR-UK-02	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, but which provide cool water, improve mainstem Klamath water River quality, and provide thermal refugia for coho salmon, particularly during warm summer months.	Potential Lead: USFS Others: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim/ Ongoing

3	D	KR-UK-03	Reduce sediment input from upslope sources, including measures to: a. Decommission skid trails and unmaintained roads where possible; b. Upgrade roads and maintenance practices; c. Stabilize slopes to minimize or prevent erosion and to minimize future risk of eroded material entering streams; and d. Minimize alteration of natural hillslope drainage patterns.	Potential Lead: USFS Others: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
3	D	KR-UK-04	Develop a plan to restore and maintain tributary and mainstem habitat connectivity where low flow or sediment aggradation is restricting coho salmon passage.	POTENTIAL LEAD: CDFG OTHERS: Caltrans, USFS, Karuk Tribe, USFS	Interim
3	D	KR-UK-05	Implement the plan to restore and maintain tributary and mainstem habitat connectivity where low flow or sediment aggradation is restricting coho salmon passage.	POTENTIAL LEAD: CDFG OTHERS: Caltrans, USFS, Karuk Tribe, USFS	Interim/ Ongoing
3	D	KR-UK-06	Implement highest priority barrier repairs as identified in the Caltrans, USFS, and the Karuk Tribe inventories, specifically the identified culverts on Highway 96 at Stanshaw, Sandy Bar, and Coon.	POTENTIAL LEAD: CDFG OTHERS: Caltrans, USFS, Karuk Tribe, USFS	Interim/ Ongoing
3	D	KR-UK-07	Develop a plan to ensure continued yields of high quality water by the maintenance and ecological function of tributary riparian systems, including measures to: a. Conduct riparian revegetation and stream bank restoration; b. Where feasible, relocate roads out of riparian areas and off of unstable land features (e.g., active landslides, granitic terrain, toe zones, wet-seepy areas); c. Increase the number of conifers and deciduous trees, where appropriate, for more stable stream banks, stream shading, and eventual recruitment of LWD; and d. Revegetate floodplain areas using native species.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim/ Ongoing
3	D	KR-UK-08	Implement the plan to ensure continued yields of high quality water by the maintenance and ecological function of tributary riparian systems.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim/ Ongoing

3	D	KR-UK-09	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; c. Planting conifers in riparian zones; and d. Release of conifers by controlling alders, blackberries, and other competitors.	POTENTIAL LEAD: USFS OTHERS: Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
3	D	KR-UK-10	Provide technical support as an incentive to landowners for ongoing efforts of restoring LWD and shade to the watershed.	POTENTIAL LEAD: USFS OTHERS: Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
3	C	KR-UK-11	Reestablish natural fire regimes consistent with the Northwest Forest Plan to reduce the risk and impact of large, severe fire on coho salmon.	POTENTIAL LEAD: USFS, BLM OTHERS: CDF, Landowners	Interim/ Ongoing
3	C	KR-UK-12	Where necessary, provide riparian protection from livestock through exclusion fencing, while establishing off-site watering.	POTENTIAL LEAD: RCDs OTHERS: Landowners	Interim/ Continual
3	E	KR-UK-13	Install screens on diversions to Department-NOAA Fisheries standards and provide funding, or other incentives to landowners where necessary to achieve this goal.	POTENTIAL LEAD: CDFG OTHERS: DWR, NOAA Fisheries	Interim
3	E	KR-UK-14	Increase efficiency of water diversions and delivery systems.	POTENTIAL LEAD: SWRCB OTHERS: CDFG, DWR	Interim
3	D	KR-UK-15	Continue restoration and monitoring of Siskon Mine to prevent further degradation of the riparian resource.	POTENTIAL LEAD: CGS OTHERS: RWQCB, EPA	Interim/ Ongoing
3	D	KR-UK-16	Request SWRCB to investigate the legality of diversions and use of water on Stanshaw Creek.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, Landowners	Interim

HAPPY CAMP HSA					
4	D	KR-HC-01	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath water River quality, and provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Improve land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request that SWRCB review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
4	D	KR-HC-02	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
4	D	KR-HC-03	Reduce sediment input from upslope sources, including measures to: a. Decommission skid trails and unmaintained roads where possible; b. Upgrade roads and maintenance practices, c. Stabilize slopes to minimize or prevent erosion and to minimize future risk of eroded material entering streams, and d. Minimize alteration of natural hillslope drainage patterns.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
4	E	KR-HC-04	Develop a plan to improve coho salmon passage at stream and road crossings, including measures to: a. Replace culverts on both USFS and Caltrans roads with structures allowing fish passage (USFS and Karuk Tribe have identified culverts under Highway 96 at Cade, Portuguese, and Fort Goff creeks as needing treatment); b. Prioritize crossings for upgrade to accommodate 100-year storm runoff and associated bedload and debris; and c. Establish an adequate funding source basin-wide for road maintenance and upgrades (possible funding sources are USFS, County and state agencies).	POTENTIAL LEAD: CDFG OTHERS: USFS, Caltrans, Karuk Tribe , Counties	Interim

4	D	KC-HC-05	Implement the plan to improve coho salmon passage at stream and road crossings.	POTENTIAL LEAD: CDFG OTHERS: USFS, Caltrans, Karuk Tribe, Counties	Long-term
4	D	KR-HC-06	Develop a plan to ensure continued yields of high quality water by the maintenance and ecological function of tributary riparian systems, including measures to: a. Conduct riparian re-vegetation and stream bank restoration; b. If feasible, relocate roads out of riparian areas and off of unstable land features (e.g., active landslides, granitic terrain, toe zones, wet-seepy areas); c. Increase the number of conifers and deciduous trees, where appropriate, for more stable stream banks, stream shading, and eventual recruitment of LWD; and d. Revegetate floodplain areas using native species.	POTENTIAL LEAD: CDFG OTHERS: USFS, Tribes, Landowners	Interim
4	D	KR-HC-07	Implement the plan to ensure continued yields of high quality water by the maintenance and ecological function of tributary riparian systems.	POTENTIAL LEAD: CDFG OTHERS: USFS, Tribes, Landowners	Interim/ Continual
4	D	KR-HC-08	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; c. Planting conifers in riparian zones; and d. Release of conifers by controlling alders, blackberries, and other competitors.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
4	C	KR-HC-09	Reestablish natural fire regimes consistent with the Northwest Forest Plan to reduce the risk and impact of large, severe fires on coho salmon.	POTENTIAL LEAD: USFS, BLM OTHERS: CDF, Landowners	Interim
4	C	KR-HC-10	Where necessary, provide riparian protection from livestock through exclusion fencing, while establishing off-site watering.	POTENTIAL LEAD: USFS OTHERS: Landowners	Interim
4	E	KR-HC-11	Install screens on diversions to Department-NOAA Fisheries standards and provide funding, or other incentives to landowners where necessary to achieve this goal.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, Landowners	Interim
4	E	KR-HC-12	Increase efficiency of water diversions and delivery systems where feasible and appropriate. Provide funding and incentives to landowners where necessary to meet this goal.	POTENTIAL LEAD: SWRCB OTHERS: CDFG, DWR	Interim

4	D	KR-HC-13	Request the NCRWQCB to continue monitoring Grey Eagle Mine and tailings as a follow-up to remediation that has already been done.	POTENTIAL LEAD: CDFG OTHERS: RWQCB	Interim
	D	KR-HC-14	Request that EPA Region 9 consider coho salmon when dealing with both emergency and remedial actions.	POTENTIAL LEAD: CDFG OTHERS: EPA	Interim
SEIAD VALLEY HSA					
4	D	KR-SV-01	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Improve land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request that the SWRCB review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
4	D	KR-SV-02	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for fish, particularly during warm summer months.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
4	D	KR-SV-03	Reduce sediment input from upslope sources by: a. Decommissioning unmaintained roads (where possible) and skid trails; b. Upgrade roads and maintenance practices; c. Stabilize slopes to minimize or prevent erosion and to minimize future risk of eroded material entering streams; and d. Minimize alteration of natural hill slope drainage patterns.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing

4	E	KR-SV-04	Improve fish passage at stream and road crossings, including measures to: a. Replace culverts on both USFS and Caltrans roads with structures allowing coho salmon passage; b. Treat coho salmon passage problems associated with the USFS roads; c. Prioritize crossings for upgrade to accommodate 100-year storm runoff and associated bedload and debris; and d. Establish an adequate funding source basin-wide for road maintenance and upgrades (possible funding sources are USFS, County and state agencies).	POTENTIAL LEAD: CDFG OTHERS: USFS, Caltrans,	Interim/ Ongoing
4	D	KR-SV-05	Develop a plan to ensure continued yields of high quality water by the maintenance and ecological function of tributary riparian systems, including measures to: a. Conduct riparian re-vegetation and stream bank restoration; b. Relocate roads out of riparian areas and off of unstable land features (e.g., active landslides, granitic terrain, toe zones, seep areas); c. Increase the number of conifers and deciduous trees, where appropriate, for more stable stream banks, stream shading, and eventual recruitment of LWD; and d. Re-vegetate floodplain areas using native species.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
4	D	KR-SV-06	Implement the plan to ensure continued yields of high quality water by the maintenance and ecological function of tributary riparian systems	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim
4	D	KR-SV-07	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; c. Planting conifers in riparian zones; and d. Release of conifers by controlling alders, blackberries, and other competitors.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
4	D	KR-SV-08	Provide technical support as an incentive to landowners for ongoing efforts of restoring LWD and shade to the watershed.	POTENTIAL LEAD: USFS, NOAA Fisheries, CDFG OTHERS: CDF, Landowners	Interim
4	C	KR-SV-09	Manage roadless areas to be consistent with land use allocations under the Northwest Forest Plan to reduce the risk of large, severe fires by re-establishing the natural fire regimes.	POTENTIAL LEAD: USFS	Interim

4	C	KR-SV-10	Where necessary, provide riparian protection from livestock through exclusion fencing, while establishing off-site watering.	POTENTIAL LEAD: USFS OTHERS: Landowners	Interim
4	E	KR-SV-11	Install screens on diversions to Department-NOAA Fisheries standards and provide funding, or other incentives to landowners where necessary to achieve this goal.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, Landowners	Interim
4	E	KR-SV-12	Study the likely benefits to instream flow of increasing the efficiency of water diversions and delivery systems where feasible and appropriate. Provide funding and incentives to landowners where necessary to meet actions that are given a high priority.	POTENTIAL LEAD: SWRCB OTHERS: CDFG, DWR	Interim
4	E	KR-SV-13	Identify illegal water diverters and request that the SWRCB take appropriate action.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, Landowners	Interim
4	E	KR-SV-14	Request that the SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, Landowners	Interim
4	D	KR-SV-15	Look for opportunities to acquire water rights for instream flow from willing participants who possess valid water rights.	POTENTIAL LEAD: CDFG OTHERS: Landowners, RCDs	Interim
4	D	KR-SV-16	Assess potential coho salmon passage problem associated with private water diversion at the mouth of Middle Creek (tributary to Horse Creek).	POTENTIAL LEAD: CDFG OTHERS: Landowners	Interim
4	D	KR-SV-17	If necessary, design and implement a remediation project for coho salmon fish passage at the mouth of Middle Creek.	POTENTIAL LEAD: CDFG OTHERS: Landowners	Interim
BEAVER CREEK HSA					
4	C	KR-BC-01	Reestablish natural fire regimes consistent with the Northwest Forest Plan to reduce the risk and impact of a large, severe fire on coho salmon.	POTENTIAL LEAD: USFS OTHERS: BLM, CDF	Long-term
4	C	KR-BC-02	Encourage landowners to manage fuels to prevent large, severe fires and to evaluate the application of the Watershed Evaluation Mitigation Addendum.	POTENTIAL LEAD: USFS OTHERS: CDF, County, Landowners, CDFG	Interim/ Ongoing
4	D	KR-BC-03	Assess fine sediment production and delivery from the USFS road adjacent to the West Fork of Beaver Creek.	POTENTIAL LEAD: USFS OTHERS:	Interim
4	D	KR-BC-04	Implement appropriate remediation for the sediment from the USFS road adjacent to the West Fork of Beaver Creek.	POTENTIAL LEAD: USFS	Interim

4	C	KR-BC-05	Hydrologically disconnect the USFS Beaver Creek Road north of West Beaver Creek.	POTENTIAL LEAD: USFS OTHERS:	Interim
4	D	KR-BC-06	Support actions to reduce sediment from upslope sources such as: a. Decommission roads and skid trails; b. Upgrade roads and maintenance practices; c. Ensure adequate coho salmon migration is provided for at stream/road crossings; d. Stabilize slopes to minimize or prevent erosion and to minimize future risk of eroded material entering streams; e. Minimize alteration of natural hillslope drainage patterns; and f. Encourage the relocation of roads out of riparian areas and off of unstable land features (e.g., active landslides, granitic terrain, toe zones, seep areas).	POTENTIAL LEAD: USFS, NOAA Fisheries OTHERS: CDFG, CDF, Landowners	Interim/ Ongoing
4	D	KR-BC-07	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Improve land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request that the SWRCB review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB, CDFG, CDF, Landowners	Interim/ Ongoing
4	D	KR-BC-08	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for fish, particularly during warm summer months.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB,CDFG, CDF, Landowners	Interim

4	E	KR-BC-09	Improve coho salmon passage at stream and road crossings, including measures to: a. Replace culverts on both USFS and Caltrans roads with structures allowing coho salmon passage; b. Treat coho salmon passage problems associated with the USFS roads; c. Prioritize crossings for upgrade to accommodate 100-year storm runoff and associated bedload and debris; and d. Encourage the USFS and County and state agencies to provide adequate budgets basin-wide for road maintenance and upgrades.	POTENTIAL LEAD: CDFG OTHERS: USFS, Caltrans,	Interim/ Ongoing
4	D	KR-BC-10	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; and c. Improvement of existing riparian zones through plantings, release of conifers, and control of alders, blackberries, and other competitors.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
4	D	KR-BC-11	Provide technical support as an incentive to landowners for ongoing efforts of restoring LWD and shade to the watershed.	POTENTIAL LEAD: USFS, NOAA Fisheries, CDFG OTHERS: CDF, Landowners	Interim
4	C	KR-BC-12	Where necessary, provide riparian protection from livestock while providing off-site watering.	POTENTIAL LEAD: USFS OTHERS: Landowners	Interim
SALMON RIVER HA					
	D	SA-HA-01	Reduce sediment and provide coho salmon passage for all life history stages where roads affect streams inhabited by coho salmon.	POTENTIAL LEAD: Road Management and Fisheries Barrier Work Group Task Force, USFS OTHERS: Landowners, County, CDFG	Interim
	D	SA-HA-02	Reduce sediment by accelerating the Northwest Forest Plan road assessment schedule.	POTENTIAL LEAD: USFS OTHERS: County, CDFG	Interim
	D	SA-HA-03	Reduce sediment where roads affect streams inhabited by coho salmon by completing the road sediment inventory assessment of County roads.	POTENTIAL LEAD: County OTHERS: USFS, CDFG	Interim/ Ongoing

	D	SA-HA-04	Reduce sediment where roads affect streams inhabited by coho salmon by implementing the treatment of the road sediment inventory of county roads.	POTENTIAL LEAD: County OTHERS: USFS, CDFG	Interim
	D	SA-HA-05	Provide coho salmon passage to all life history stages where roads affect streams inhabited by coho salmon implement the recommendations for the completed assessment of barriers.	POTENTIAL LEAD: County, Road Management and Fisheries Barrier Work Group Task Force OTHERS: USFS, CDFG, Landowners	Interim
	E	SA-HA-06	Foster the multi-agency task force to identify and prioritize barriers to fish passage, and implement corrective treatments.l. This task force would include at a minimum, representatives from the Salmon River Restoration Council, Karuk Tribe, USFS, NOAA Fisheries, USFWS, and the Department.	POTENTIAL LEAD: Road Management and Fisheries Barrier Work Group Task Force (Salmon River Restoration Council, Karuk Tribe, USFS., NOAA Fisheries, USFWS, County, and CDFG)	Interim/ Ongoing
	D	SA-HA-07	Educate landowners, restoration specialist, and watershed groups to reduce the impacts of private roads on coho salmon.	POTENTIAL LEAD: CDFG, Road Management and Fisheries Barrier Work Group Task Force OTHERS: Salmon River Restoration Council, Landowners	Interim/ Ongoing
	C	SA-HA-08	Encourage collaborative efforts among agencies and stakeholders to control or remove invasive exotics using integrated pest management techniques, emphasizing manual treatments.	POTENTIAL LEAD: CDFG, Salmon River Noxious Weed Management Area Groups OTHERS : Landowners, academia, native plant advocacy	Interim/ Ongoing
	C	SA-HA-09	Reduce the risk of large, severe fires through fuels management around residential structures, homes, and fire escape routes. Implement Salmon River Fire Safe Council recommendations promoting the reduction of fuel near residences to reduce human-caused fires spreading into the forest and causing harm to coho salmon habitat.	POTENTIAL LEAD: Salmon River Fire Safe Council OTHERS: County, CDFG, CDF, USFS	Interim/ Ongoing
	C	SA-HA-10	Reestablish fire regimes consistent with Northwest Forest Plan objectives to reduce the risk and impact of large, severe fire on coho salmon.	POTENTIAL LEAD: CDFG, NOAA Fisheries, Salmon River Fire Safe Council OTHERS: USFS	Interim
	C	SA-HA-11	If necessary, integrate coho salmon conservation into the Northwest Forest Plan regarding fire suppression and overall fuel management plan.	POTENTIAL LEAD: USFS	Interim

	D	SA-HA-12	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade, primarily in tributaries and key refugia areas, through: a. LWD placement; b. Management to promote conifer recruitment; c. Improvement of existing riparian zones through plantings, release of conifers, and control of alders, blackberries, and other competitors; and d. Incentives to landowners, such as technical support.	POTENTIAL LEAD: USFS, CDFG OTHERS: NOAA Fisheries, Watershed Groups, County, USFWS, Karuk Tribe, Salmon River Reststoration Council, Landowners	Interim/ Ongoing
	C	SA-HA-13	Develop a plan to prioritize and remediate mine tailings.	POTENTIAL LEAD: CDFG, CGS, North Coast RWQCB, USFS OTHERS: NOAA Fisheries, Karuk Tribe, USFWS, Salmon River Restoration Council, Landowners	Interim/ Ongoing
	C	SA-HA-14	Implement the plan to remediate prioritized mine tailings, focusing on tributaries and key area of the Salmon River.	POTENTIAL LEAD: CGS, USFS, North Coast RWQCB OTHERS: NOAA Fisheries, CDFG, USFWS, Karuk Tribe, Salmon River Restoration Council	Interim/ Ongoing
LOWER SALMON HSA					
3	D	SR-LS-01	Restore and maintain habitat connectivity between the Salmon River and Nordheimer Creek where low flow or sediment aggradation has been known to restrict coho salmon passage.	POTENTIAL LEAD: USFS, Watershed Group OTHERS: Karok	Interim/ Ongoing
		SR-LS-02	*Support ongoing maintenance and operations for the Nordheimer Creek Fish Ladder*	POTENTIAL LEAD: OTHERS:	

SAWYERS BAR HSA					
3	D	SR-SB-01	Reduce current and future sediment inputs to Specimen, North Russian, and South Russian creeks: a. Do road upgrade/improvement/maintenance/storm proofing (out sloping roads, reducing hydrologic connectivity); b. Provide slope stabilization where feasible; c. Reduce or avoid alteration of natural hill slope drainage patterns: and d. Upgrade stream/road crossings and ensure coho salmon passage.	POTENTIAL LEAD: USFS, Watershed Group OTHERS: Karok	Interim/ Ongoing
3	D	SR-SB-02	Conduct riparian re-vegetation and stream bank stabilization along entire North Fork: a. Control vegetation removal in the streamside zone; b. Increase the number of conifers and deciduous trees to provide stable stream shading and which will eventually become a source for LWD; and c. Re-vegetate floodplain areas using native species.	POTENTIAL LEAD: USFS, Watershed Group OTHERS: Karok	Interim/ Ongoing
SHASTA VALLEY AND SCOTT RIVER HSA (See Chapter 10 for recommendations for agricultural land and water use.)					
4	C	SS-HA-01	Reduce the risk of large, severe fires (especially in the Scott) by implementing the Fire Safe Council's recommendations promoting the reduction of fuel near residences to reduce human-caused fires spreading into the forest and causing harm to coho salmon habitat.	POTENTIAL LEAD: CDF, USFS OTHERS: County, Landowners, CDFG	Interim/ Ongoing
4	D	SS-HA-02	Reduce human-caused sediment input from upslope sources identified through public and private inventories.	POTENTIAL LEAD: USFS, CDF, Landowners OTHERS: Caltrans, County, CDFG	Interim/ Ongoing
4	D	SS-HA-03	Prioritize and implement remediation activities for human-caused sediment, which would include slope stabilization, minimizing sediment production, and eliminating coho salmon passage barriers.	POTENTIAL LEAD: USFS, CDF, Landowners OTHERS: Caltrans, County, CDFG	Interim/ Ongoing
4	D	SS-HA-04	Encourage federal, state, and county agencies and private landowners to reduce impacts to coho salmon habitat from public and private road systems.	POTENTIAL LEAD: CDFG OTHERS: USFS, CDF, Caltrans, County, Landowners	Interim

4	D	SS-HA-05	Continue road and/or watershed assessments to identify and prioritize sources and risks of road-related sediment delivery to watercourses.	POTENTIAL LEAD: Counties, USFS OTHERS: CDFG, CDF, Caltrans, Landowners	Interim/ Ongoing
4	D	SS-HA-06	Reduce road densities where necessary and appropriate.	POTENTIAL LEAD: Counties, USFS OTHERS: CDFG, CDF, Caltrans, Landowners	Interim
4	D	SS-HA-07	Decrease potential for stream flow to become diverted at road crossings during high flow events, resulting in flow along the road that returns to the channel at undesirable locations.	POTENTIAL LEAD: Counties, USFS OTHERS: CDFG, CDF, Caltrans, Landowners	Interim/ Ongoing
4	D	SS-HA-08	Stabilize slopes along roadways to minimize or prevent erosion and to minimize future risk of eroded material entering streams.	POTENTIAL LEAD: Counties, USFS OTHERS: CDFG, CDF, Caltrans, Landowners	Interim
4	D	SS-HA-09	Minimize alteration of natural hill slope drainage patterns to decrease erosion and sediment input into the streams.	POTENTIAL LEAD: Counties, USFS OTHERS: CDFG, CDF, Caltrans, Landowners	Interim
4	D	SS-HA-10	Encourage funding authorities to allocate adequate budgets to federal, state, and local agencies and private landowners for road maintenance activities, capital project activities, and dedicated funding to pay for coho salmon passage projects.	POTENTIAL LEAD: CDFG, Counties, USFS, NOAA Fisheries OTHERS: CDF, Caltrans, Landowners	Interim
4	E	SS-HA-11	Encourage funding authorities to allocate adequate resources to prioritize and upgrade crossings to provide coho salmon passage within the range of coho salmon to pass 100-year flows and the expected debris loads (e.g., LWD that might be mobilized).	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFS, CDF, Landowners	Interim/ Ongoing
4	E	SS-HA-12	Identify barriers to passage and prioritize them for removal, through collaborative efforts with other agencies.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, USFS, Caltrans, CDF, County, Landowners	Interim/ Ongoing
4	C	SS-HA-13	Design a reclamation plan to remediate effects of historical mining (i.e., tailings near Callahan) with the goal of enhancing the production and survival of coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, County, CGS, Landowners	Interim

4	C	SS-HA-14	Implement the reclamation plan that remedies effects of historical mining (i.e., tailings near Callahan) with the goal of enhancing the production and survival of coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, County, CGS, Landowners	Interim
4	C	SS-HA-15	Identify locations, costs, and restoration potential of intensively mined areas.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries, County, CGS, Landowners	Interim
4	D	SS-HA-16	Improve water quality by reducing or minimizing both domestic and municipal sources of nutrient input (i.e., sewage treatment plant discharge and storm drain runoff). Support efforts by cities and rural communities to complete system upgrades to achieve CWA compliance.	POTENTIAL LEAD: RWQCB OTHERS: County, Landowners, CDFG	Interim/ Ongoing
4	D	SS-HA-17	Minimize impacts of cattle grazing on watercourses though exclusion fencing as necessary and appropriate (i.e., providing off-site watering, preventing overgrazing, etc.).	POTENTIAL LEAD: RCDs OTHERS: Landowners, CDFG, NOAA Fisheries	Interim, Ongoing
4	D	SS-HA-18	Support cooperative state and local efforts to redirect Big Mill Creek into its historic channel under State Route 3, thereby restoring adult and juvenile coho salmon access to approximately 1.25 miles of quality spawning and rearing habitat.	POTENTIAL LEAD: CDFG OTHERS: Caltrans, Landowners	Interim
4	E	SS-HA-19	Assess the potential benefits and technical feasibility of increasing stream flows in the Scott River for fish and wildlife within the Klamath National Forest.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, DWR, Landowners	Interim
4	D	SS-HA-20	Request the USBR to study the potential benefits of adjusting Iron Gate flows to better meet the needs of adult and juvenile life stages to enhance Scott/Shasta coho salmon production, consistent with the flow needs of the Klamath and Trinity rivers.	POTENTIAL LEAD: CDFG OTHERS: USBR	Interim
4	D	SS-HA-21	Complete the comprehensive, peer-reviewed watershed restoration plans for the Shasta and Scott rivers that include identification and prioritization of all restorative needs in each basin. When restoration funds are limited, implementation should occur on the highest priority issues most likely to effectively address coho salmon needs within each basin.	POTENTIAL LEAD: RCDs, Watershed Council OTHERS: CDFG, NOAA Fisheries, USFWS	Interim/ Ongoing
4	C	SS-HA-22	Financially support ongoing watershed planning.	POTENTIAL LEAD: RCDs, Watershed Council OTHERS: CDFG, NOAA Fisheries, USFWS	Interim/ Ongoing

4	E	SS-HA-23	Preserve water quality, quantity and coho salmon habitat in the Big Springs area in the Shasta River by possibly using incentive-based alternatives with willing participants.	POTENTIAL LEAD: CDFG OTHERS: Landowners, RCD	Interim/ Continual
4	E	SS-HA-24	Maintain and re-vegetate, where appropriate, riparian trees in headwaters and along creeks that provide shade habitat essential for coho salmon.	POTENTIAL LEAD: CDFG OTHERS: Landowners, RCD	Interim/ Continual
4	D	SS-HA-25	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; and b. Management to promote conifer recruitment.	POTENTIAL LEAD: CDFG OTHERS: Landowners, RCD	Interim/ Ongoing
HORNBROOK HSA					
4	D	KR-HB-01	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Improve land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request that the SWRCB review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB,CDFG, CDF, Landowners	Interim/ Ongoing
4	D	KR-HB-02	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB,CDFG, CDF, Landowners	Interim/ Ongoing

4	E	KR-HB-03	Improve coho salmon passage at stream and road crossings, including measures to: a. Replace culverts on both the USFS and Caltrans roads with structures allowing coho salmon passage; b. Treat coho salmon passage problems associated with the USFS roads; c. Prioritize crossings for upgrade to accommodate 100-year storm runoff and associated bedload and debris; and d. Encourage the USFS, County and state agencies to provide adequate budgets basin-wide for road maintenance and upgrades.	POTENTIAL LEAD: CDFG OTHERS: USFS, Caltrans	Interim/ Ongoing
4	D	KR-HB-04	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; c. Improvement of existing riparian zones through plantings, release of conifers, and control of alders, blackberries, and other competitors; and d. Incentives to landowners, such as technical support.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing
4	E	KR-HB-05	Study the likely benefits to instream flow of increasing the efficiency of water diversions and delivery systems where feasible and appropriate. Provide funding and incentives to landowners where necessary to meet actions that are given a high priority.	POTENTIAL LEAD: SWRCB OTHERS: CDFG, DWR	Interim
4	E	KR-HB-06	Identify water diverters; request that the SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, Landowners	Interim
4	D	KR-HB-07	Look for opportunities to acquire water rights for instream flow from willing participants who possess valid water rights.	POTENTIAL LEAD: CDFG OTHERS: Landowners, RCDs	Interim

IRON GATE HSA					
4	D	KR-IG-01	Develop a plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months. The plan should: a. Improve land management to reduce impacts to riparian corridors, reduce sediment loads, and protect water resources; b. Request that the SWRCB review existing water appropriations for compliance; c. Petition the SWRCB to designate streams with critical summer flows as fully appropriated streams during the appropriate period; and d. Provide measures that reduce hydrologic connectivity between streams and roads where feasible.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB,CDFG, CDF, Landowners	Interim/ Ongoing
4	D	KR-IG-02	Implement the plan to protect and restore tributaries, even those that do not support populations of coho salmon, that provide cool water, improve mainstem Klamath River water quality, and provide thermal refugia for coho salmon, particularly during warm summer months.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, RWQCB,CDFG, CDF, Landowners	Interim/ Ongoing
4	E	KR-IG-03	Improve coho salmon passage at stream and road crossings, including measures to: a. Replace culverts on both USFS and Caltrans roads with structures allowing coho salmon passage; b. Treat coho salmon passage problems associated with the USFS roads; c. Prioritize crossings for upgrade to accommodate 100-year storm runoff and associated bedload and debris; and d. Encourage the USFS, County and state agencies to provide adequate budgets basin-wide for road maintenance and upgrades.	POTENTIAL LEAD: USFS, Caltrans OTHERS: CDFG,	Interim/ Ongoing
4	D	KR-IG-04	Supplement on-going efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through: a. LWD placement; b. Management to promote conifer recruitment; c. Improvement of existing riparian zones through plantings, release of conifers, and control of alders, blackberries, and other competitors; and d. Incentives to landowners, such as technical support.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Landowners	Interim/ Ongoing

4	E	KR-IG-05	Study the likely benefits to instream flow of increasing the efficiency of water diversions and delivery systems where feasible and appropriate. Provide funding and incentives to landowners where necessary to meet actions that are given a high priority.	POTENTIAL LEAD: SWRCB OTHERS: CDFG, DWR	Interim
4	E	KR-IG-06	Identify water diverters and request that the SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, Landowners	Interim
4	D	KR-IG-07	Look for opportunities to acquire water rights for instream flow from willing participants who possess valid water rights.	POTENTIAL LEAD: CDFG OTHERS: Landowners, RCDs	Interim
TRINITY RIVER HU					
	E	TR-HU-01	Implement the Trinity River Record of Decision (ROD), which would provide: a. Variable annual instream flows for the Trinity River from the Trinity River Dam (TRD) based on forecasted hydrology for the Trinity River Basin as of April 1st of each year, ranging from 369,000 acre-feet in critically dry years to 815,000 af in extremely wet years; b. Physical channel rehabilitation, including the removal of riparian berms and the establishment of side-channel habitat; c. Sediment management, including the supplementation of spawning gravels below the TRD and reduction in fine sediments which degrade coho salmon habitats; d. Watershed restoration efforts, addressing negative impacts which have resulted from land use practices in the Basin; and e. Infrastructure improvements or modifications, including rebuilding or fortifying bridges and addressing other structures affected by the peak instream flows provided by the ROD.	POTENTIAL LEAD: USBR OTHERS: USFS, NOAA Fisheries, USFWS, CDFG	Interim
	C	TR-HU-02	Recommend to the NCRWQCB that the TMDL process consider alterations in the sediment load allocations and targets due to implementation of the ROD.	POTENTIAL LEAD: CDFG OTHERS: RWQCB	Interim
	D	TR-HU-03	Implement the Trinity River TMDL instream flushing flows without affecting ROD allocations.	POTENTIAL LEAD: CDFG, USBR OTHERS:, RWQCB	Interim
	D	TR-HU-04	Establish TMDL implementation plans for the mainstem and South Fork using the upslope indicators and targets established in the Main Stem Load Allocation.	POTENTIAL LEAD: CDFG, RWQCB OTHERS: USBR	Interim
	E	TR-HU-05	Develop a County grading ordinance based on exemption, certification, and permitting criteria.	POTENTIAL LEAD: County OTHERS: CDFG	Long-term

	C	TR-HU-06	Implement county grading ordinance based on exemption, certification, and permitting criteria.	POTENTIAL LEAD: County OTHERS: CDFG	
	C	TR-HU-07	Implement the Five Counties Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California Watersheds.	POTENTIAL LEAD: Trinity County OTHERS: CDFG	Interim/ Continual
	D	TR-HU-08	Support continued state and federal funding for the implementation of sediment reduction programs for private lands and the implementation and funding of treatment of sediment source sites on County roads using the prioritization of the Direct Inventory of Roads and Their Treatment (DIRT).	POTENTIAL LEAD: County OTHERS: Landowners, CDFG	Interim/ Ongoing
	C	TR-HU-09	Establish incentives and standards for private riparian and wetland areas protection based on flexible subdivision design; road, curb and gutter requirements; minimum lot size and density; clustering and other techniques.	POTENTIAL LEAD: CDFG OTHERS: County	Interim
	C	TR-HU-10	Establish riparian setbacks for grading activities on private lands, based on Department 1994 recommendations to District I counties.	POTENTIAL LEAD: CDFG OTHERS: County	Interim
	D	TR-HU-11	Evaluate the impacts of non-native fish species on coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries	Interim
	D	TR-HU-12	Develop management guidelines to reduce impacts from non-native fish species.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries	Interim
	C	TR-HU-13	Develop or amend existing County Conservation, Open Space and Land Use Elements and Community Plans to focus development away from riparian habitats, wetland habitats, or steep slopes. Consider all species habitats, wildland-urban fire hazard, and other land uses factors in making allocations.	POTENTIAL LEAD: CDFG OTHERS: Trinity County	Interim
	C	TR-HU-14	Analyze the feasibility and appropriateness of site-specific 2084 authorization for sport fishing for hatchery coho salmon.	POTENTIAL LEAD: CDFG OTHERS: NOAA Fisheries	Interim
DOUGLAS CITY HSA					
5	E	TR-DC-01	Investigate all water diversions on Reading Creek, Indian Creek, and Browns Creek.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, NOAA Fisheries	Interim
5	E	TR-DC-02	Restore coho salmon passage and instillation of screens to Department-NOAA Fisheries standards. Provide incentives to landowners when necessary to reach this goal.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, NOAA Fisheries	Interim

5	D	TR-DC-03	Increase riparian function in lower Reading, Indian, Browns creeks with conservation easements or landowner incentives that reduce agricultural and grazing impacts.	POTENTIAL LEAD: CDFG OTHERS: RCD, Landowners	Interim/ Ongoing
5	D	TR-DC-04	Implement sediment reduction plans consistent with County plans and policies.	POTENTIAL LEAD: CDFG OTHERS: RCD, County, Landowners	Interim/ Ongoing
GROUSE CREEK HSA					
3	D	TR-GC-01	Continue implementation of habitat restoration, including measures to stabilize upslope areas, enhance riparian zones, storm proof, stabilize, and/or decommission roads, and replace culverts.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, County, RCD, CDFG, CDF, Landowners	Interim/ Ongoing
HYAPOM HSA					
2	D	TR-HY-01	Develop a management plan for Big Slide to reduce human contributions to mobilization of sediments, including evaluating relocation of the county road that crosses Big Slide.	POTENTIAL LEAD: USFS OTHERS: CDFG, County	Interim
2	D	TR-HY-01	Implement the management plan for Big Slide to reduce human contributions to mobilization of sediments, including evaluating relocation of the county road that crosses Big Slide.	POTENTIAL LEAD: USFS, County OTHERS: CDFG	Interim
2	C	TR-HY-02	Manage forest stands to reduce their susceptibility to large, severe fires. Where appropriate, this should include actions to accelerate the growth of conifers for LWD recruitment, develop mature shade canopy in the riparian zone, and to provide for other multiple use goals.	POTENTIAL LEAD: CDFG OTHERS: USFS	Interim/ Ongoing
2	D	TR-HY-03	Continued implementation of habitat restoration, including measures to stabilize upslope areas, enhance riparian zones, storm proof, stabilize, and/or decommission roads, and replace culverts.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, County, RCD, CDFG, CDF, Landowners	Interim/ Ongoing
HAYFORK HSA					
2	E	TR-HA-01	Establish agricultural/residential water conservation programs using incentive programs if necessary.	POTENTIAL LEAD: CDFG OTHERS: SWRCB, Landowners	Interim/ Ongoing

2	D	TR-HA-02	Amend Trinity County's Critical Water Resources Overlay zone to address new riparian water rights developed as a result from parcel subdivision. The amendment should include expanding the overlay zoning to additional watersheds where summer surface flows are limiting factors for residents and coho salmon.	POTENTIAL LEAD: CDFG OTHERS: County	Interim
2	C	TR-HA-03	Continue implementation of riparian improvements through restoration activities, land use planning, and conservation easements.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, CDFG, CDF, Private Landowners	Interim/ Ongoing
2	D	TR-HA-04	Support efforts to provide livestock exclusion fencing where feasible and appropriate, while providing off-site watering.	POTENTIAL LEAD: Landowners, RCDs OTHERS: NRCS	Interim/ Continual
2	D	TR-HA-05	Continue to implement habitat restoration, including measures to stabilize upslope areas, enhance riparian zones, storm proof, stabilize, and/or decommission roads, and replace culverts.	POTENTIAL LEAD: USFS OTHERS: NOAA Fisheries, County, RCD, CDFG, CDF, andowners	Interim/ Ongoing

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