U.S. Fish & Wildlife Service

Klamath Recovery Unit Implementation Plan for Bull Trout

(Salvelinus confluentus)

Resident bull trout at Dixon Creek. Oregon Department of Fish and Wildlife

Klamath Recovery Unit

Implementation Plan

for

Bull Trout (*Salvelinus confluentus*)

September 2015

Prepared by

U.S. Fish and Wildlife Service

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Introduction

This recovery unit implementation plan (RUIP) describes the threats to bull trout (*Salvelinus confluentus*) and the site-specific management actions necessary for recovery of the species within the Klamath Recovery Unit, including estimates of time required and cost. This document supports and complements the Recovery Plan for the Coterminous U.S. Population of Bull Trout (USFWS 2015a), which describes recovery criteria and a general range-wide recovery strategy for the species. Detailed discussion of species status and recovery actions within each of the six recovery units is provided in six RUIPs that have been developed in coordination with State, Federal, Tribal, and other conservation partners. This document incorporates our responses to public comment on the Draft Klamath RUIP (USFWS 2015b) received during the comment period from June 4 to July 20, 2015 (Appendix I).

The Klamath River and its tributaries flow through a total of seven counties, two in southern Oregon (Klamath and Jackson Counties) and five in northwestern California (Modoc, Siskiyou, Trinity, Humboldt, and Del Norte Counties), before reaching the Pacific Ocean. The Klamath River basin consists of approximately 4 million hectares (10 million acres) and has its headwaters in south-central Oregon (Buchanan *et al.* 1997). Elevations vary from 840 meters (2,755 feet) in the Klamath River canyon at the state line to 2,894 meters (9,495 feet) on Mt. McLoughlin in the Cascade Range and 2,549 meters (8,364 feet) on Gearhart Mountain at the eastern edge of the basin. Most of the drainage tributaries of the upper basin funnel through Upper Klamath Lake, elevation 1,261 meters (4,140 feet), before emptying into the Link River and Lake Ewauna at the head of the Klamath River (Buchanan *et al.* 1997).

The climate of the Klamath River basin, the product of wind from the west and the Cascade rain shadow, varies from sub-humid to semi-arid depending on elevation (NRC 2004). Average annual precipitation ranges from 36 centimeters (14 inches) in Klamath Falls to 165 centimeters (65 inches) at Crater Lake; precipitation comes primarily as winter snow, with little rainfall during the growing season (Gannett *et al.* 2007). While precipitation is generally greater in the higher elevations, much of the surface water for perennial streams is supplied by springs below 2,042 meters (6,700 feet). Runoff primarily consists of a base-level perennial discharge from springs and seasonal (mid spring) discharge from snowmelt. Rare rain-on-snow events may also occur in early fall or during spring snowmelt. Growing seasons are typically dry with localized thunderstorms. Temperatures vary widely both diurnally and seasonally. Summer temperatures are generally warm with a mean July maximum of 29° Celsius [C] (85° Fahrenheit [F]) at Klamath Falls and 20° C (68° F) at Crater Lake. Winter temperatures are generally cold with a mean January minimum of -7° C (20° F) at Klamath Falls and -8° C (18° F) at Crater Lake (Gannett *et al.* 2007).

The upper Klamath River basin lies within the geologic area known as the Basin and Range Province (NRC 2004), which includes portions of the Cascade Range and the Modoc Plateau. The Cascade Range extends northward through Oregon and Washington into British Columbia, and the Modoc Plateau extends into Oregon and southeastward into Nevada. The outstanding characteristics of the region are: (1) the dominance of volcanism and (2) the presence of broad areas of nearly flat basalt plains (NRC 2004). The Klamath River basin region of the Modoc Plateau supports some large and geologically old wetlands. The river systems of this area were once connected to both the Snake River drainage to the north and east and the Sacramento and San Joaquin drainage to the south.

Historical records reviewed by Hamilton et al. (2005) and genetic information obtained from archaeological sites analyzed by Butler and Stevenson (2010) indicate that prior to the construction of Copco 1 Dam in 1918 on the Klamath River, Chinook salmon and steelhead spawned in the tributaries upstream of Upper Klamath Lake. Bull trout, Chinook salmon and steelhead trout have evolved sympatrically throughout much of the bull trout range (69 FR 59996; 75 FR 63898; USFWS 2002a) and there is historical evidence that this sympatry included the upper Klamath River basin (Hamilton et al. 2005). The presence of anadromous fish species in the bull trout range increased the prey base and provided marine derived nutrients that supported the persistence of bull trout.

The Klamath Recovery Unit is located in southern Oregon and includes three bull trout core areas (Upper Klamath Lake, Sycan River, and Upper Sprague River), all within the upper Klamath River basin (Figure B-1) (USFWS 2008a).

The Upper Klamath Lake core area comprises the northern portion of the lake and its immediate major and minor tributaries. The lake has a surface area of 37,231 hectares (92,000 acres). Major tributaries are the Williamson and Wood rivers. Numerous small streams that are fed by springs and surface water originate along the rim of the basin. This core area includes waters draining from Crater Lake National Park south of Scott Peak (2,720 meters (8,927 feet)) and from the area west of and including the Williamson River below Klamath Marsh. Also included is the west side of the Fremont-Winema National Forest from Crater Lake National Park south into the Varney Creek drainage on the west side of Klamath Lake. This core area includes two existing local bull trout populations: Threemile Creek and Sun Creek. Sun Creek, originating in Crater Lake National Park, currently supports the largest local population in the Upper Klamath Lake core area.

The Sycan River core area comprises Sycan Marsh, the Sycan River, and their tributaries. The Sycan River originates from springs at an elevation near 2,134 meters (7,000 feet) on the eastern edge of the Klamath River basin. The river flows through high-elevation meadows and forest lands for 74 kilometers (km) (46 miles). It flows through Sycan Marsh for 15 km (9.3 miles), and then flows through a variety of landscapes for 56 km (35 miles) until it joins the Sprague River. This core area is composed of the waters that drain into the Sycan Marsh, including Long, Calahan, and Coyote creeks on the west side of the marsh. On the east side of the marsh are the upper Sycan River, Chocktoot Creek, Shake Creek, and their tributaries. The only local bull trout population in the Sycan River core area occurs in Long Creek. Long Creek is driven by a snow melt hydrograph, but base flow is largely spring fed. Bull trout, including a fluvial[1] life-history form (up to 510 millimeters [20 inches]); Light *et al.* 1996), have been found distributed throughout most of the length of Long Creek.

The Upper Sprague River core area is comprised of drainages of the North Fork and South Fork of the Sprague River upstream of their confluence, including Deming, Boulder, Dixon, Brownsworth, and Leonard creeks. The North Fork and South Fork Sprague rivers originate mostly from small, spring-fed streams near 2,103 meters (6,900 feet) in elevation on the north and southeast sides of Gearhart Mountain. The upper reaches of each river meander through high-elevation meadow and forest lands before being confined by narrow forested canyons (Buchanan *et al.* 1997). The lower reaches of the North Fork and South Fork Sprague rivers meander through the broad, low-gradient Sprague River valley and have been heavily modified for agriculture. Deming Creek is believed to support the largest local population of bull trout in the Upper Sprague River core area. A snorkel survey in 1997 and an angler report in 2000 documented fluvial bull trout (355 to 400 millimeters (14.0 to 15.7 inches) in the North Fork Sprague River below the confluence with Boulder Creek (USFWS 2002b). Anglers have reported catching bull trout (approximately 203 millimeters (8 inches)) in the North Fork Sprague River 200 meters (656 feet) upstream of Boulder Creek in 2013 (Jared Bottcher, Klamath Basin Rangeland Trust, pers. comm.) and approximately 5.3 km (3.3 miles) downstream of Boulder Creek in 2014 (Mark Hereford, U.S. Geological Survey, pers. comm.).

Current Status of Bull Trout in the Klamath Recovery Unit

Bull trout in the Klamath Recovery Unit have been isolated from other bull trout populations for the past 10,000 years and are recognized as evolutionarily and genetically distinct (Minckley *et al.* 1986; Leary *et al.* 1993; Whitesel *et al.* 2004; USFWS 2008a; Ardren *et al.* 2011). As such, there is no opportunity for bull trout in another recovery unit to naturally re-

[1] Fluvial life history: Bull trout that spawn in tributary streams and migrate to larger rivers to mature.

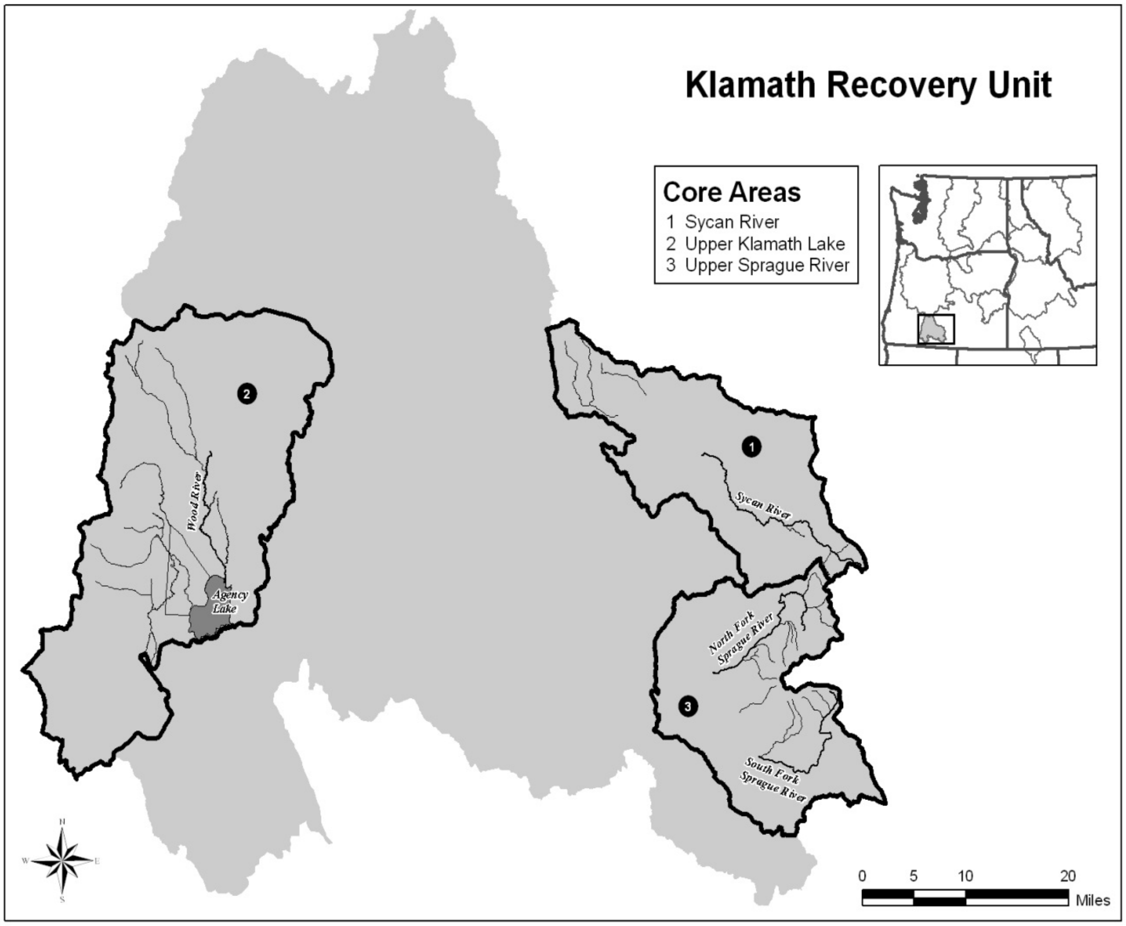

Figure B-1. Map of the Klamath Recovery Unit for bull trout.

colonize the Klamath Recovery Unit if it were to become extirpated. The Klamath Recovery Unit lies at the southern edge of the species range and occurs in an arid portion of the range of bull trout.

Bull trout were once widespread within the Klamath River basin (Gilbert 1897; Dambacher *et al.* 1992; Ziller 1992; USFWS 2002b), but habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, and past fisheries management practices have greatly reduced their distribution. Bull trout abundance also has been severely reduced, and the remaining populations are highly fragmented and vulnerable to natural or manmade factors that place them at a high risk of extirpation (USFWS 2002b). The presence of nonnative brook trout (*Salvelinus fontinalis*), which compete and hybridize with bull trout, is a particular threat to bull trout persistence throughout the Klamath Recovery Unit.

Upper Klamath Lake Core Area

The Upper Klamath Lake core area comprises two bull trout local populations (Sun Creek and Threemile Creek). These local populations likely face an increased risk of extirpation because they are isolated and not interconnected with each other. Extirpation of other local populations in the Upper Klamath Lake core area has occurred in recent times (1970s). Populations in this core area are genetically distinct from those in the other two core areas in the Klamath Recovery Unit (USFWS 2008b), and in comparison, genetic variation within this core area is lowest. The two local populations have been isolated by habitat fragmentation and have experienced population bottlenecks. As such, currently unoccupied habitat is needed to restore connectivity between the two local populations and to establish additional populations. This unoccupied habitat includes canals, which now provide the only means of connectivity as migratory corridors. Providing full volitional connectivity for bull trout, however, also introduces the risk of invasion by brook trout, which are abundant in this core area.

Bull trout in the Upper Klamath Lake core area formerly occupied Annie Creek, Sevenmile Creek, Cherry Creek, and Fort Creek, but are now extirpated from these locations. The last remaining local populations, Sun Creek and Threemile Creek, have received focused attention. Brook trout have been removed from bull trout occupied reaches, and these reaches have been intentionally isolated to prevent brook trout reinvasion. As such, over the past few generations these populations have become stable and have increased in distribution and abundance. In 1996, the Threemile Creek population had approximately 50 fish that occupied a 1.4-km (0.9-mile) reach (USFWS 2002b). In 2012, a mark-resight population estimate was completed in Threemile Creek, which indicated an abundance of 577 (95 percent confidence interval = 475 to 679) age-1+ fish (ODFW 2012). In addition, the length of the distribution of bull trout in Threemile Creek had increased to 2.7 km (1.7 miles) by 2012 (USFWS unpublished data). Between 1989 and 2010, bull trout abundance in Sun Creek increased approximately tenfold (from approximately 133 to 1,606 age-1+ fish) and distribution increased from approximately 1.9 km (1.2 miles) to 11.2 km (7.0 miles) (Buktenica *et al.* 2013).

Sycan River Core Area

The Sycan River core area is comprised of one local population, Long Creek. Long Creek likely faces greater risk of extirpation because it is the only remaining local population due to extirpation of all other historic local populations. Bull trout previously occupied Calahan Creek, Coyote Creek, and the Sycan River, but are now extirpated from these locations (Light *et al.* 1996). This core area's local population is genetically distinct from those in the other two core areas (USFWS 2008b). This core area also is essential for recovery because bull trout in this core area exhibit both resident[2] and fluvial life histories, which are important for representing diverse life history expression in the Klamath Recovery Unit. Migratory bull trout are able to grow larger than their resident counterparts, resulting in greater fecundity and higher reproductive potential (Rieman and McIntyre 1993). Migratory life history forms also have been shown to be important for population persistence and resilience (Dunham *et al.* 2008).

The last remaining population (Long Creek) has received focused attention in an effort to ensure it is not also extirpated. In 2006, two weirs were removed from Long Creek, which increased the amount of occupied foraging, migratory, and overwintering (FMO) habitat by 3.2 km (2.0 miles). Bull trout currently occupy approximately 3.5 km (2.2 mi) of spawning/rearing habitat, including a portion of an unnamed tributary to upper Long Creek, and seasonally use 25.9 km (16.1 mi) of FMO habitat. Brook trout also inhabit Long Creek and have been the focus of periodic removal efforts. No recent statistically rigorous population estimate has been completed for Long Creek; however, the 2002 Draft Bull Trout Recovery Plan reported a population estimate of 842 individuals (USFWS 2002b). Currently unoccupied habitat is needed to establish additional local populations, although brook trout are widespread in this core area and their management will need to be considered in future recovery efforts. In 2014, the Klamath Falls Fish and Wildlife Office of the U.S. Fish and Wildlife Service (Service) established an agreement with the U.S. Geological Survey to undertake a structured decision making process to assist with recovery planning of bull trout populations in the Sycan River core area.

Upper Sprague River Core Area

The Upper Sprague River core area comprises five bull trout local populations, placing the core area at an intermediate risk of extinction. The five local populations include Boulder Creek, Dixon Creek, Deming Creek, Leonard Creek, and Brownsworth Creek. These local populations may face a higher risk of extirpation because not all are interconnected. Bull trout local populations in this core area are genetically distinct from those in the other two Klamath Recovery Unit core areas (USFWS 2008b). Migratory bull trout have occasionally been observed in the North Fork Sprague River (USFWS 2002b). Therefore, this core area also is

[2] Resident: Life history pattern of residing in tributary streams for the fish's entire life without migrating.

essential for recovery in that bull trout here exhibit a resident life history and likely a fluvial life history, which are important for conserving diverse life history expression in the Klamath Recovery Unit as discussed above for the Sycan River core area.

The Upper Sprague River core area population of bull trout has experienced a decline from historic levels, although less is known about historic occupancy in this core area. Bull trout are reported to have historically occupied the South Fork Sprague River, but are now extirpated from this location (Buchanan *et al.* 1997). The remaining five populations have received focused attention. Although brown trout (*Salmo trutta*) co-occur with bull trout and exist in adjacent habitats, brook trout do not overlap with existing bull trout populations. Efforts have been made to increase connectivity of existing bull trout populations by replacing culverts that create barriers. Thus, over the past few generations, these populations have likely been stable and increased in distribution. Population abundance has been estimated recently for Boulder Creek (372 ± 62 percent; Hartill and Jacobs 2007), Dixon Creek (20 ± 60 percent; Hartill and Jacobs 2007), Deming Creek (1,316 ± 342; Moore 2006), and Leonard Creek (363 ± 37 percent; Hartill and Jacobs 2007). No statistically rigorous population estimate has been completed for the Brownsworth Creek local population; however, the 2002 Draft Bull Trout Recovery Plan reported a population estimate of 964 individuals (USFWS 2002b). Additional local populations need to be established in currently unoccupied habitat within the Upper Sprague River core area, although brook trout are widespread in this core area and will need to be considered in future recovery efforts.

Factors Affecting Bull Trout in the Klamath Recovery Unit

Within the Klamath Recovery Unit, at least nine historic local populations of bull trout have become extirpated, and restoring additional local populations will be necessary to achieve recovery (Light *et al.* 1996; Buchanan *et al.* 1997; USFWS 2002b). Establishing new local populations will involve evaluating locations where suitable cold-water habitats can be maintained or restored as well as prioritizing sites and stream reaches for habitat restoration and genetic suitability of populations considered as sources for translocation. Recovery efforts that have been identified include restoring bull trout spawning/rearing and FMO habitats in the Wood River valley and reconnecting these habitats to Agency Lake; restoring and reconnecting both occupied and unoccupied habitats in the Sycan River core area; and restoring streams, improving water management, and removing existing entrainment sources and migration barriers in the North Fork and South Fork Sprague rivers.

Competition and hybridization with brook trout is considered one of the primary threats to bull trout recovery in all three core areas of the Klamath Recovery Unit (USFWS 2002b). The Service supports ongoing brook trout control efforts and re-establishing bull trout populations without hybrid elements (USFWS 2002b). The feasibility of brook trout removal in stream reaches where historic bull trout local populations were extirpated should be explored.

Brown trout, which occur in the Upper Klamath Lake and Upper Sprague River core areas, may also threaten bull trout. The effects of brown trout on bull trout are not well understood and much remains to be learned; however, they may directly compete with bull trout (USFWS 2002b) and superimpose their redds over bull trout redds (Lockard and Carlson 2005). Interactions between bull trout and brown trout should be studied, and control measures should be implemented where appropriate and feasible to prevent or reduce effects on bull trout.

Historic cattle grazing has had a strong influence on riparian vegetation and stream bank stability in the Klamath River basin. Historical records from the Bureau of Indian Affairs and the U.S. Forest Service show heavy livestock grazing from 1911 to the 1950s (Buchanan *et al.* 1997). Livestock grazing, which is still currently the major agricultural activity in the upper Klamath River basin, has led to an increase in sediment and nutrient loading rates by accelerating erosion (USFWS 2002b; McCormick and Campbell 2007). Cattle have heavily grazed floodplains, wetlands, forests, rangelands, and riparian areas, resulting in the degradation of these areas. Poorly managed grazing operations can alter the streamside riparian vegetation and compact soil surfaces, increasing groundwater runoff, lowering streambank stability, and reducing fish cover. Although livestock grazing has been reduced along most bull trout-occupied stream reaches, grazing and its associated impacts still occur upstream and downstream of known habitat and in drainages that were historically occupied and have potential for restoration. In these areas, implementation of different grazing regimes to reduce impacts to bull trout habitat are needed to achieve full recovery. This may include temporary removal or significant reduction in number of permitted cattle on priority stream reaches (identified below).

Throughout the upper Klamath River basin, timber harvesting and associated activities (*e.g.*, road building) by Federal, State, Tribal, and private landowners have resulted in soil erosion on harvested lands and transport of sediment into streams and rivers adjacent to or downstream from those lands (USFWS 2002b; NRC 2004). Past logging and road-building practices often did not provide for adequate soil stabilization and erosion control. A high density of forest roads remains in the upper Klamath River basin, and many of these are located near streams where they likely contribute sediment (USFS 2010; Richard Pyzik, USFS, pers. comm.). These sediments result in an increase of fine soil particles that can cover spawning substrata. The negative effects from past and current timber harvesting practices are a threat to the long-term persistence of bull trout in the Klamath River basin.

A mountain pine beetle epidemic has affected pine trees in Klamath County since 2001 in and around the Gearhart Mountain Wilderness. Many smaller patches of pine mortality are spread throughout Klamath County. Mortality from bark beetles has increased each year. The primary limiting factor for these large populations of mountain pine beetles is available food supply (*i.e.*, mature, overstocked pine). An aerial survey in 2010 indicated an increase in affected area from 2009. A 133,897-hectare (330,867-acre) "red zone" has been identified as being the core of the Gearhart Mountain Wilderness outbreak, including both affected acreage and susceptible acreage (USFS 2009). Included within the red zone are approximately 50,000 hectares (125,000 acres) of private land. These fire-prone areas may be at increased risk of wildfire, and forest management techniques may need to be applied to reduce the risks that wildfire can have on bull trout and their essential cold-water habitats (Falke *et al.* 2015).

Water control structures and agricultural diversions have contributed to the decline of bull trout in the Klamath Recovery Unit. Without ensuring adequate water flow, screens at diversions, and passage at water control structures, these structures will continue to impede recovery of bull trout in the Klamath Recovery Unit. Unscreened irrigation diversions exist in each of the three core areas. These diversions should be assessed for their magnitude of impacts and feasibility of screening to inform screening priority order. Providing passage at water control structures and ensuring sufficient water quantity for bull trout also will be necessary for recovery.

Most existing bull trout local populations within the Klamath Recovery Unit have small population sizes and are isolated from one another, which may confer genetic risks and reduce the likelihood of population persistence over time. General guidance indicates closed populations may show signs of inbreeding depression after a few generations with an effective population size (N_e) of less than 50 individuals; over longer time scales, closed populations could lose genetic variation due to random effects of genetic drift when N_e falls below 500 (Rieman and Allendorf 2001; Whitesel *et al.* 2004). Rieman and Allendorf (2001) provided a conservative estimate of N_e to be 0.5 times the mean number of bull trout adults observed annually. Thus, to avoid inbreeding depression, 100 (*i.e.*, 100 x 0.5 = 50) spawning adults may be needed in any population whereas 1,000 (1,000 x 0.5 = 500) spawning adults may be needed to avoid the loss of genetic variation within a population or group of populations among which gene flow occurs (Rieman and Allendorf 2001). Populations of bull trout may, therefore, benefit from management actions to increase the number of spawning adults and gene flow (*e.g.*, improving habitat capacity, removing demographic threats, and establishing additional local populations).

Genetic variability generally persists at relatively low levels within the Klamath Recovery Unit bull trout populations, particularly in the Upper Klamath Lake core area. Because population sizes in the Klamath Recovery Unit have been substantially reduced and many bull trout local populations are isolated, concerns exist about the potential for breeding among closely related individuals (*i.e.*, inbreeding) in these local populations. Given that bull trout populations in the Klamath Recovery Unit would benefit from genetic exchange, yet populations will likely continue to remain isolated in the near term, translocation of individuals may be useful to supplement natural gene flow (USFWS 2008b). However, to exercise precaution the Service and other entities will consult with professional geneticists to inform implementation measures prior to any translocation.

Human-induced climate change could exacerbate threats to bull trout and their habitat during future droughts. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff *et al.* 2002; Koopman *et al.* 2009; PRBO Conservation Science 2011). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling *et al.* 2006) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout.

Ongoing Klamath Recovery Unit Conservation Measures (Summary)

In the Upper Klamath Lake core area, suitable habitat for bull trout in Sun Creek and Threemile Creek have expanded by removing nonnative fish (brook trout, bull trout × brook trout hybrids, and brown trout [Sun Creek only]) through recent piscicide and electrofishing treatments, and by installing exclusion barriers to prevent re-invasion by nonnatives (Buktenica *et al.* 2013; USFWS unpublished data). Within Threemile Creek, future recovery actions include adding large woody debris to increase pool habitat, channel restoration, and channel enhancement in downstream reaches for improved connectivity. Within Sun Creek, future conservation work includes reconnecting Sun Creek to the Wood River, which will allow full connectivity to FMO habitat (mainstem Wood River and Agency Lake) and to additional spawning and rearing habitat. In addition to these two streams, ongoing conservation actions within the core area include acquiring water rights for additional instream flow, replacing diversion structures, installing fish screens, constructing bypass channels, and installing riparian fencing. The ongoing conservations actions have been conducted by or are being undertaken by multiple entities, including Crater Lake National Park, Oregon Department of Forestry, Oregon Department of Fish and Wildlife, The Klamath Tribes, Fremont-Winema National Forest, Klamath Basin Rangeland Trust, the U.S. Fish and Wildlife Service, and private landowners.

In the Sycan River core area, recent changes in land management have begun restoring historic forest structure, species composition and function to reduce the risk of catastrophic wildfire. Removal of water control structures in Sycan Marsh has restored the historic hydrologic regime. Eliminating these structures will allow streams to access their floodplains, which may potentially buffer the impacts of projected changes in future stream flow. Additional restoration activities include increasing riparian vegetation to reduce channel width and improve instream habitat conditions, and restoring hardwoods in riparian areas to provide microhabitats that reduce the effects of irradiance (Lawler *et al.* 2010; Wong and Bienz 2011). Barrier removal has established connectivity from Long Creek to Upper Klamath Lake. Culvert barriers have been replaced in Coyote Creek and in tributaries to the upper Sycan River. Brook trout control efforts in Long Creek have been ongoing, but have not yet been shown to be effective. A structured decision making approach (Conroy and Peterson 2012) was recently initiated to provide management direction. The goal of the process is to achieve long-term viability of bull trout populations in the Sycan River core area through expanding and maintaining existing populations, establishing new populations, and improving stream and riparian habitats. Additional ongoing recovery actions within the Sycan River core area include Sycan River realignment within the Sycan Marsh. Achieving realignment will reconnect the Sycan River to Long Creek, which will open 60 miles of Sycan River and tributary habitat to bull trout. Cooperators in recovery actions include The Nature Conservancy, Fremont-Winema National Forest, Oregon Department of Fish and Wildlife, The Klamath Tribes, Green Diamond Resource Company, U.S. Geological Survey, and the U.S. Fish and Wildlife Service.

In the Upper Sprague core area, bull trout habitat restoration efforts have included culvert replacements, removals, or modifications in multiple streams to provide the opportunity for bull trout to express migratory behavior, allow for genetic exchange, and increase resiliency to potential catastrophic events, such as wildfire. Bull trout within Leonard and Brownsworth creeks now have full volitional access to the entire drainage network. Additionally, large woody debris has been added to these two creeks to improve instream habitat. Within Boulder Creek, one barrier culvert has been replaced and the last culvert is scheduled to be replaced, which will provide access to the entire stream system. Within Deming Creek, culvert replacement has occurred and plans are in place to replace and/or modify additional culverts to improve fish passage. Habitat restoration efforts for Deming Creek have been initiated or is ongoing and includes riparian fencing, adding large woody debris, riparian plantings, and improved grazing management. Future plans are in place for reconnecting Deming Creek to the South Fork Sprague River. Additional ongoing conservation actions include large woody debris additions to the South Fork Sprague River and installing a fish screen on the North Fork Sprague River to prevent entrainment. Cooperators in recovery actions include the Fremont-Winema National Forest, Oregon Department of Fish and Wildlife, The Klamath Tribes, Klamath Basin Rangeland Trust, Green Diamond Resource Company, Deming Ranch Land and Cattle, the Service, and private landowners.

Research, Monitoring, and Evaluation

Research, monitoring, and evaluation will be useful to assess the future effectiveness of threats management and determine whether demographically stable or increasing populations exist within each of the core areas. Some monitoring occurs and is planned for areas of the Klamath Recovery Unit. Crater Lake National Park has monitored the Sun Creek local population of bull trout annually since 1992 and intends to continue to do so into the future. Restoration plans are in place to reconnect Sun Creek to the Wood River, and Crater Lake National Park, with support from other entities, intends to monitor the Sun Creek bull trout population response following reconnection. Since 2011, the U.S. Geological Survey and the Service have monitored bull trout response to large woody debris additions and culvert replacements or modifications at Leonard and Brownsworth creeks. The Fremont-Winema National Forest monitors habitat conditions on grazing allotments that contain bull trout critical habitat. Some monitoring of bull trout local populations is accomplished by additional organizations, but surveys are not completed on a regular schedule or currently tied to an overall monitoring plan or strategy.

As threats to bull trout within the Klamath Recovery Unit are addressed currently and into the future, it will be important to implement a statistically rigorous monitoring program to evaluate the effectiveness of recovery efforts through assessment of demographic responses by bull trout (USFWS 2008c). Multiple entities will likely be required to participate in annual monitoring since no one entity will be able to complete sampling in each year in the entire recovery unit. As such, the monitoring program will need to take into account the flexibility to allocate monitoring efforts among sites in the Klamath Recovery Unit (*e.g.*, rotating panel design).

Table B-1. Primary threats for the Klamath Recovery Unit (by core area).

Core Area – Complex **(≥ 2 local populations)** ***Core Area – Simple*** ***(one local population)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnatives***
Upper Klamath Lake	**2**	**Upland/ Riparian Land Management** (1.1) Legacy forest management and agricultural practices – channelization and habitat degradation.	**Connectivity Impairment** (2.1) Lack of connectivity to FMO habitat (Wood River, Agency Lake); unscreened irrigation diversions (entrainment, dewatering); fish passage issues. **Small Population Size** (2.3) The two local populations have small population sizes, particularly Threemile Creek, and are isolated from one another, which may confer genetic risks and reduce the likelihood of population persistence over time; lack of migratory life history.	**Nonnative Fishes** (3.1) Brook trout, and to some extent, brown trout, are numerous in all historically occupied and suitable spawning/rearing and FMO habitat.
Sycan River	**1**	**Upland/ Riparian Land Management** (1.1) Legacy forest management and agricultural practices – channelization and habitat degradation.	**Connectivity Impairment** (2.1) Lack of connectivity to FMO habitat (mainstem Sycan River); unscreened irrigation diversions (entrainment, dewatering); fish passage issues. **Small Population Size** (2.3) Long Creek is the only remaining local population, which may confer genetic risks and reduce the likelihood of population persistence over time.	**Nonnative Fishes** (3.1) Brook trout are numerous in all historically occupied and suitable spawning/rearing and FMO habitat. Hybridization and competition presently occurs in Long Creek.

Core Area – Complex **(≥ 2 local populations)** ***Core Area – Simple*** ***(one local population)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnatives***
Upper Sprague River	**5**	**Upland/ Riparian Land Management** (1.1) Legacy forest management and agricultural practices – channelization and habitat degradation.	**Connectivity Impairment** (2.1) Lack of connectivity to FMO habitat (between North Fork and South Fork Sprague River); unscreened irrigation diversions (entrainment, dewatering); fish passage issues. **Small Population Size** (2.3) The local populations have small population sizes, particularly Boulder, Dixon, and Leonard creeks, and nearly all are isolated from one another, which may confer genetic risks and reduce the likelihood of population persistence over time; lack of migratory life history.	**Nonnative Fishes** (3.1) Brook trout, and to some extent, brown trout, are numerous in all historically occupied and suitable spawning/rearing and FMO habitat. Brown trout presently occur with bull trout in Boulder, Dixon, Leonard, and Brownsworth creeks.

[1] **Primary Threat**: *Factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (50 years).*

As indicated previously, the effects of brown trout on bull trout are not well understood. Research should evaluate interactions between bull trout and brown trout and possible control measures should be implemented where appropriate and feasible to prevent or reduce brown trout effects to bull trout. Additional research needs in the Klamath Recovery Unit include determining the factors that limit expression of the migratory life history in bull trout.

Recovery Measures Narrative

Within the Klamath Recovery Unit, the primary threats within each of the three core areas are generally similar (Table B-1). Bull trout in each of the core areas face threats from nonnative salmonids (*i.e.*, brook trout and, in some instances, brown trout), small population size, degraded instream and riparian habitat, and impaired connectivity. Low numbers of local populations within core areas place populations at increased risk from genetic and demographic threats. Given these primary threats, the following actions to achieve recovery in the Klamath Recovery Unit may include, but are not limited to, the following:

- Improve bull trout spawning, rearing, and FMO habitat by addressing stream restoration, water management, migration barriers, and entrainment (*e.g.*, fish screens).
- Maintain (where already in good condition) and improve (where conditions are poor) water quality and quantity within bull trout critical habitat (*e.g.*, through addressing 303(d) impairments).
- Identify, improve, and restore upland conditions that negatively affect bull trout habitats where needed to conserve bull trout.
- Eradicate or otherwise prevent or reduce threats to bull trout from nonnative fish (*i.e.*, brook trout, bull trout × brook trout hybrids, and brown trout) populations in bull trout critical habitat within each core area, as well as in areas connected to critical habitat, if necessary. This action should involve an evaluation of trade-offs involved with any use of barriers to upstream movement.
- Implement management actions to increase the number of spawning adults and gene flow to reduce the risk of inbreeding depression and loss of genetic variation.
- Establish the migratory bull trout life history form in suitable locations, in addition to protecting resident forms that currently exist.
- Establish additional bull trout local populations in historically occupied streams or those that have suitable cold-water habitats. This requires that streams being considered for

bull trout occupancy provide environmental conditions and spatial extent necessary to meet population requirements.

- At the time of the listing in 1999, climate change effects were not considered as a factor affecting bull trout. However, bull trout are vulnerable to the effects of warming climates, changing precipitation and hydrologic regimes, and are considered a useful indicator species of the effects climate change will have on the mountainous stream ecosystems where they reside. Several climate change assessments or studies have been published that allow us to better understand how climate change may influence bull trout, which will help to identify suitable conservation actions to improve the status of bull trout and ensure bull trout persist in the face of climate change. This will be especially important within the Klamath Recovery Unit where bull trout persist at the southern margin of their range.

- Assess the need and identify appropriate source populations for captive propagation of bull trout to support reintroduction efforts in the Klamath Recovery Unit where local populations have been extirpated. Effects of nonnative fishes and dispersal barriers largely prohibit natural recolonization within this recovery unit, and poor demographic health of bull trout populations suggests that a controlled propagation program may be necessary to support reintroduction efforts and prevent extirpation of additional local populations. Propagation may involve various methods, including but not limited to, *in situ* rearing of larvae and/or juveniles in semi-natural environments, cages, or ponds, or more intensive (traditional) hatchery methods. These efforts could contribute to reestablishment of local populations in all three core areas of the Klamath Recovery Unit.

The recovery measures narrative provides a list of individual recovery actions needed within the Klamath Recovery Unit, organized by core area. The recovery measures narrative for each core area within the Klamath Recovery Unit is structured in a hierarchical step-down narrative under which specific recovery actions are grouped and listed to address identified primary threats. We established three broad primary threat category classifications (habitat, demographic, and non-natives) which were further subdivided into more specific second tier threat categories where applicable:

Habitat – Upland/Riparian Land Management, Instream Impacts, and Water Quality

Demographic – Connectivity Impairment, Fisheries Management, Small Population Size, and Forage Fish Availability

Nonnatives – Nonnatives

Specific recovery actions are each listed under a third tier of individual threat descriptors which were developed to more specifically characterize these second tier threat categories for that particular core area. If a second tier threat category is not applicable to a particular core area, no third tier threats are listed in the narrative and the second tier threat is shaded gray. Core areas, shared FMOs, and their specific recovery actions have been grouped by the three major geographic regions.

Upper Klamath Lake Core Area

1. Actions to Address Habitat Threats

1.1 Upland/Riparian Land Management

1.1.1 Improve grazing management practices. Where investigation indicates actions are likely to benefit bull trout habitat, improve grazing management practices. Priority stream reaches include critical habitat in the Wood River valley.

1.1.2 Improve timber harvest management practices. Where investigation indicates actions are likely to benefit bull trout habitat, improve timber harvest management practices.

1.2 Instream Impacts

1.2.1 Identify impaired stream channel and riparian areas and implement tasks to restore. The lower reaches of many of the creeks have been altered where they meet the floor of the Wood River valley. At these locations, many of the streams have been diverted, channelized, and lost riparian habitat. Efforts should focus on restoration at the lower reaches of Sun and Annie creeks near the Wood River and the lower reaches of Sevenmile, Threemile, and Cherry creeks near West and Sevenmile canals.

1.2.2 Rectify entrainment, dewatering, and other negative effects on bull trout. Unscreened water diversions exist within the Annie Creek, Sun Creek, Sevenmile Creek, Cherry Creek, and the Wood River that result in fish entrainment. Water rights transfers should be pursued to provide additional instream flow at these locations, particularly in the summer and fall.

1.3 Water Quality

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

2.1.1 Identify barriers and, where appropriate, implement tasks to provide passage. In cases where the benefit of passage outweighs the risk of non-native invasion, reconnect both occupied and unoccupied streams to allow for: 1) the opportunity for genetic exchange, 2) the potential to recolonize streams, 3) the expression of migratory life histories, and 4) resiliency against catastrophic events. Efforts should focus on spawning/rearing and FMO habitats in the following locations: Sun Creek, Annie Creek, Sevenmile Creek, Threemile Creek, Cherry Creek, Fort Creek, Crooked Creek, West Canal, and Wood River.

2.2 Fisheries Management

2.3 Small Population Size

2.3.1 Develop a genetic management plan and guidelines for appropriate use of translocation and controlled propagation. Effects of nonnative fishes and dispersal barriers largely prohibit natural recolonization within this recovery unit, and poor demographic health of bull trout populations suggests that translocation and/or a controlled propagation program may be necessary to support reintroduction efforts and prevent extirpation of additional local populations.

2.3.2 Implement actions to increase the number of spawning adults and improve gene flow (*e.g.*, improving habitat capacity, removing demographic threats, and establishing additional local populations).

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

3.1.1 Develop tasks to reduce negative effects of established nonnative taxa on bull trout. The feasibility of brook trout removal in stream reaches where historic bull trout local populations were extirpated should be explored to determine whether brook trout can be eliminated and/or managed and bull trout re-established. These efforts should focus on Annie Creek, Sevenmile Creek, Cherry Creek, Fort Creek, Crooked Creek, and adjacent habitats that may serve as source populations.

Sycan River Core Area

1. Actions to Address Habitat Threats

1.1 Upland/Riparian Land Management

1.1.1 Improve grazing management practices. Where investigation indicates actions are likely to benefit bull trout habitat, improve grazing management practices. Priority stream reaches include Long Creek, Boulder Creek, Rifle Creek, the South Fork Sycan River, and upper Sycan River.

1.1.2 Improve timber harvest management practices. Where investigation indicates actions are likely to benefit bull trout habitat, improve timber harvest management practices.

1.2 Instream Impacts

1.2.1 Identify impaired stream channel and riparian areas and implement tasks to restore. The lower reach of the Sycan River has been altered where it meets the Sycan Marsh. At this location, the stream has been diverted, channelized, and lost riparian habitat. Efforts should focus on restoration at the Sycan Marsh to connect to Long Creek to provide additional access to spawning and rearing and FMO habitat in the upper Sycan River drainage.

1.2.2 Rectify entrainment, dewatering, and other negative effects on bull trout. Unscreened water diversions exist within Long Creek and in the Sycan River at “weir 2” that result in fish entrainment. Water rights transfers should be pursued to provide additional instream flow, particularly in the summer and fall, at Long Creek and the Sycan River.

1.3 Water Quality

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

2.1.1 Identify barriers and, where appropriate, implement tasks to provide passage. In cases where the benefit of passage outweighs the risk of non-native invasion, reconnect both occupied and unoccupied streams to allow for: 1) the opportunity for genetic exchange, 2) the potential to recolonize streams, 3) the expression of migratory life histories, and 4) resiliency against catastrophic events. Efforts should focus on spawning, and rearing, and FMO habitats in the following locations: Calahan Creek, Coyote Creek, and Sycan River.

2.2 Fisheries Management

2.3 Small Population Size

2.3.1 Develop a genetic management plan and guidelines for appropriate use of translocation and controlled propagation. Effects of nonnative fishes and dispersal barriers largely prohibit natural recolonization within this recovery unit, and poor demographic health of bull trout populations suggests that translocation and/or a controlled propagation program may be necessary to support reintroduction efforts and prevent extirpation of additional local populations.

2.3.2 Implement actions to increase the number of spawning adults and improve gene flow (*e.g.*, improving habitat capacity, removing demographic threats, and establishing additional local populations).

2.3.3 Develop and implement a structured decision making approach to management. Structured decision making should be implemented to achieve long term viability of bull trout populations in the Sycan River core area. This approach will assist in making management decisions to expand and maintain the existing population (Long Creek), establish new populations, and improve stream and riparian habitats while: 1) acknowledging budgetary constraints, 2) complying with Federal and State regulatory mandates, 3) providing angling opportunities, 4) maintaining flexibility for managing consumptive uses of private and Federal lands, and 5) acknowledging Tribal interests.

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

3.1.1 Develop tasks to reduce negative effects of established nonnative taxa on bull trout. The feasibility of brook trout removal in stream reaches where historic bull trout local populations were extirpated should be explored to determine whether brook trout can be eliminated and/or managed and bull trout re-established. These efforts should focus on Calahan Creek, Coyote Creek, Boulder Creek, Rifle Creek, the South Fork Sycan River, and upper Sycan River.

Upper Sprague Core Area

1. Actions to Address Habitat Threats

1.1 Upland/Riparian Land Management

1.1.1 Improve grazing management practices. Where investigation indicates actions are likely to benefit bull trout habitat, improve grazing management practices. Priority stream reaches include Camp Creek, Corral Creek, South Fork Sprague River, Deming Creek, and North Fork Sprague River.

1.1.2 Improve timber harvest management practices. Where investigation indicates actions are likely to benefit bull trout habitat, improve timber harvest management practices.

1.2 Instream Impacts

1.2.1 Identify impaired stream channel and riparian areas and implement tasks to restore. Reaches of some of the creeks have been altered at low-gradient headwater areas or where they exit confined canyons and gradient decreases. At these locations, many of the streams have been diverted, channelized, or feature degraded riparian habitat. Efforts should focus on restoration at the lower reaches of Deming Creek, South Fork Sprague River, and North Fork Sprague River.

1.2.2 Rectify entrainment, dewatering, and other negative effects on bull trout. Unscreened water diversions exist within Deming Creek and the South Fork Sprague River, which results in fish entrainment. Water rights transfers should be pursued to provide additional instream flow, particularly in the summer and fall, at Deming Creek. A hydroelectric facility on the North Fork Sprague River requires appropriate screen size and appropriate seasonal water withdrawals.

1.3 Water Quality

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

2.1.1 Identify barriers and, where appropriate, implement tasks to provide passage. In cases where the benefit of passage outweighs the risk of non-native invasion, reconnect both occupied and unoccupied streams to allow for: 1) the opportunity for genetic exchange, 2) the potential to recolonize streams, 3) the expression of migratory life histories, and 4) resiliency against catastrophic events. Efforts should focus on spawning/rearing and FMO habitats in the following locations: Camp Creek, Corral Creek, South Fork Sprague River, Boulder Creek, Deming Creek, Dead Cow Creek, and North Fork Sprague River.

2.2 Fisheries Management

2.3 Small Population Size

2.3.1 Develop a genetic management plan and guidelines for appropriate use of translocation and controlled propagation. Effects of nonnative fishes and dispersal barriers largely prohibit natural recolonization within this recovery unit, and poor demographic health of bull trout populations suggests that a controlled propagation program may be necessary to support reintroduction efforts and prevent extirpation of additional local populations.

2.3.2 Implement actions to increase the number of spawning adults and improve gene flow (*e.g.*, improving habitat capacity, removing demographic threats, and establishing additional local populations).

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

3.1.1 Develop tasks to reduce negative effects of established nonnative taxa on bull trout. The feasibility of brook trout or brown trout removal in stream reaches where historic bull trout local populations were extirpated should be explored to determine whether brook trout and brown trout can be eliminated and/or managed and bull trout re-established. These efforts should focus on Leonard Creek, Brownsworth Creek, Boulder Creek, Dixon Creek, Camp Creek, Corral Creek, upper North Fork Sprague River, and upper South Fork Sprague River.

4. Research, Monitoring, and Evaluation (*all core areas*)

4.1 Habitat

4.1.1 Use all available conservation programs and regulations to protect and conserve bull trout habitat.

4.1.2 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas. Promote collaborative efforts by supporting local watershed groups and private landowners in developing and implementing site-specific restoration activities.

4.1.3 Enforce existing Federal, State, and Tribal habitat protection standards.

4.2 Demographic

4.2.1 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery actions.

4.2.2 Design and implement a statistically rigorous monitoring program to assess the effectiveness of recovery efforts on demographic response by bull trout and their habitats. Addressing threats to bull trout recovery should lead to a positive demographic response by bull trout, which may include, but is not limited to, additional local populations, establishment of a migratory life history, increases in amount of occupied habitat, and multiple age classes of bull trout.

4.2.3 Evaluate effects of existing or emerging diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

4.2.4 Continue to provide information to anglers about bull trout identification and special regulations. The majority of the identification posters along occupied bull trout streams are missing, faded, or in disrepair. Seek funding opportunities to purchase relevant identification posters (*i.e.*, depicting the more common resident life history form) for periodic placement for angler and public education efforts.

4.3 Nonnatives

4.3.1 Interactions between bull trout and brown trout should be studied and control measures implemented where appropriate and feasible to prevent or reduce effects to bull trout.

Conservation Recommendation

- Support actions to reintroduce anadromous species. Anadromous species, such as Chinook salmon and steelhead, were historically present in the upper Klamath River basin and their reintroduction would support bull trout recovery by increasing prey base and providing marine derived nutrients. Feasibility of restoration of spawning Chinook salmon and steelhead populations should be evaluated and implemented where feasible and biologically supportable.

Implementation Schedule for the Klamath Recovery Unit

The Implementation Schedule that follows describes recovery action priorities, action numbers, action descriptions, duration of actions, potential participants or participating responsible parties, total cost estimate and estimates for the next 5 years, if available, and comments. These recovery actions, when accomplished in conjunction with implementation of recovery actions in the other bull trout recovery units, will lead to recovery of bull trout in the coterminous United States as discussed in the Bull Trout Recovery Plan (USFWS 2015a).

Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the Implementation Schedule. This list of parties does not preclude other entities from assisting with implementation of recovery actions. Listing a responsible party does not imply that prior approval has been given or require that party to participate or expend any funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery action identified in an approved recovery plan, and is therefore part of a coordinated effort to recover bull trout. In addition, section 7(a)(1) of the Endangered Species Act directs all Federal agencies to use their authorities to further the purposes of the Act by implementing programs for the conservation of threatened or endangered species.

Interrelated Costs of Recovery Actions

The majority of recovery actions outlined in the Klamath Recovery Unit implementation schedule are being carried out (or will be) for the direct benefit to bull trout. However, several recovery actions benefit bull trout but are being undertaken primarily for the purpose of ecosystem restoration in general. Those actions include the following: identifying and restoring impaired stream channels; rectifying entrainment and dewatering; improving grazing management practices; improving timber management practices; and using conservation programs and regulations to improve habitat. Implementation of these actions is done under other regulatory mechanisms such as the National Forest Management Act (land and resource management plans), the National Environmental Policy Act, State water regulations, and through various programs aimed at habitat restoration in the upper Klamath River basin.

Threat Factor: Listing factor or threat category addressed by the recovery action.

A. The present or threatened destruction, modification or curtailment of bull trout habitat or range;

B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence

Recovery Action Priority:

Priority 1: An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2: An action that must be taken to prevent a significant decline in species population or habitat quality.

Priority 3: All other actions necessary to meet the recovery objectives.

We evaluate action priorities relative to the core area(s) where the action is targeted. Action priorities may reflect both the severity of the threat and the expected effectiveness of the action in addressing it.

Research, monitoring and evaluation (RM&E) actions necessary for recovery are those deemed critical for developing information for planning, implementing, monitoring, and evaluating effectiveness of recovery actions addressing management of primary threats. Depending on the level of importance of this information, these RM&E actions may be classified as Priority 1, 2, or 3.

Recovery Action Number and Description: Recovery actions as numbered in the recovery outline. Refer to the Narrative for action descriptions.

Recovery Action Duration: Indicates the number of years estimated to complete the action, or other codes defined as follows:

Continual (C) – An action that will be implemented on a routine basis once begun.

Ongoing (O) – An action that is currently being implemented and will continue until no longer necessary.

To be Determined (TBD) – The action duration is not known at this time or implementation of the action is dependent on the outcome of other recovery actions.

Responsible or Participating Party: The following organizations are those with responsibility or capability to fund, authorize, or carry out the corresponding recovery tasks.

GDRC	Green Diamond Resource Company
KBRT	Klamath Basin Rangeland Trust
KT	Klamath Tribes
LRMA	All resource and land management agencies, private landowners, Tribal

	entities, and nongovernmental organizations affected by or responsible for bull trout conservation
NPS	National Park Service
ODFW	Oregon Department of Fish and Wildlife
ODF	Oregon Department of Forestry
TNC	The Nature Conservancy
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Cost estimates: Estimated costs assigned to each recovery action identified in the Implementation Schedule, both for the first 5 years after release of the recovery plan and for the total estimated cost of recovery (based on time to recovery, for Continual or Ongoing actions). Cost estimates are not provided for tasks which are normal agency responsibilities under existing authorities.

Time to Recovery: Estimated time before this recovery unit could meet recovery criteria, if recovery actions are successfully implemented.

Table B-2. Klamath Recovery Unit Implementation Schedule.

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
All	A	1	2.1.1	Identify and remedy barriers	O	LRMA		2,000	400	400	400	400	400
All	A, D	1	1.2.1	Identify and restore impaired stream channels	O	LRMA		15,000	3,000	3,000	3,000	3,000	3,000
All	A, D	1	1.2.2	Rectify entrainment and dewatering	O	LRMA		15,000	3,000	3,000	3,000	3,000	3,000
All	A	2	1.1.1	Improve grazing management practices	O	USFS, USFWS, GDRC, TNC		500	100	100	100	100	100
All	A	2	1.1.2	Improve timber management practices	O	LRMA		500	100	100	100	100	100
All	E	1	2.3.1	Develop genetic management plan for use of translocation and/or propagation	TBD	ODFW, USFWS		200	40	40	40	40	40
All	A, E	1	2.3.2	Increase the number of spawning adults and increase gene flow	TBD	LRMA		1,000	200	200	200	200	200

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Sycan River	E	2	2.3.3	Implement structured decision making approach to guide management	O	USFWS, ODFW, TNC, USFS, KT, GDRC, USGS	In progress	60	5	5	5	5	5
All	C	1	3.1.1	Reduce negative effects of nonnative taxa	O	LRMA		2,000	400	400	400	400	400
All	E	3	4.1.1	Use conservation programs and regulations to improve habitat	TBD	LRMA		10	2	2	2	2	2
All	E	3	4.1.2	Use partnerships to protect, maintain, and restore functioning habitat	TBD	LRMA		10	2	2	2	2	2
All	D	2	4.1.3	Enforce existing federal, state, and tribal habitat protection standards	TBD	ODFW, ODF, KT, USFWS, USFS		75	15	15	15	15	15

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
All	E	3	4.2.1	Research and monitoring to implement and evaluate recovery actions	C	LRMA		500	100	100	100	100	100
All	E	3	4.2.2	Design a statistically rigorous monitoring program	TBD	ODFW, USFWS		100	20	20	20	20	20
All	C	3	4.2.3	Monitor for and remedy emerging diseases or parasites	O	ODFW, USFWS		500	100	100	100	100	100
All	B	3	4.2.4	Provide anglers information on bull trout identification and regulations	C	ODFW, USFWS		75	15	15	15	15	15
Upper Klamath Lake, Upper Sprague River	E	3	4.3.1	Research interactions between bull trout and brown trout and prevent or reduce effects	TBD	ODFW, USFWS, USGS		125	25	25	25	25	25
Time to Recovery (estimated time required to meet recovery criteria within this recovery unit) – 50 to 70 years													
Estimated total cost of recovery actions within this recovery unit - $37,655,000													

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Appendix I. Summary of the Comments on the Draft Recovery Unit Implementation Plan for the Klamath Recovery Unit

Background

On June 4, 2015, we released draft recovery unit implementation plans addressing each of the six recovery units that comprise the coterminous United States population of bull trout for a 45-day comment period for Federal agencies, Native American Tribes, State and local governments, and members of the public. The public comment period ended on July 20, 2015.

This section provides a summary of general information about the comments received specific to the Draft Klamath RUIP (USFWS 2015b), including the numbers and breakdown of comments (letters) from various sources.

We received two comment letters for the Klamath Recovery Unit. Comment letters were received from the following:

Federal Agencies (0)

State Agencies (1)

Native American Tribes (0)

Utilities/Commissions/Counties (0)

Environmental/Conservation Organizations (1)

Individuals (0)

Public comments ranged from editorial suggestions to providing new information. As appropriate, we have incorporated all applicable edits and suggestions into the text of the final Klamath RUIP. The following is a summary of substantive comments, and our responses to those comments and suggestions, that were either not incorporated into the Klamath RUIP or that were incorporated partially or fully but need additional explanation or justification. General or global comments pertaining to rangewide recovery issues for bull trout are addressed in Appendix D of the final recovery plan (USFWS 2015a).

1. *Comment:* Insert language into this measure (in all core areas) to ensure that conservation entities evaluate the risk of non-native species before providing passage at, or removing, barriers. This evaluation must occur on a case-by-case basis. The commenter is concerned in some cases

that the removal of barriers may allow nonnative species to invade areas occupied by allopatric bull trout. Our suggested edits are in bold:

“2.1.1 Identify barriers and**, where appropriate,** implement tasks to provide passage. **In cases where the benefit of passage outweighs the risk of non-native invasion,** reconnect both occupied and unoccupied streams to allow for: 1) the opportunity for genetic exchange, 2) the potential to recolonize streams, 3) the expression of migratory life histories, and 4) resiliency against catastrophic events. Efforts should focus on spawning/rearing and FMO habitats.”

Response: We have incorporated the commenter’s suggested language into the recovery measures narrative for each core area. The commenter also recommended that reintroduction of anadromous fish to the upper Klamath River basin should be included in the plan. As such, we have included reintroduction of Chinook salmon and steelhead as a conservation recommendation. We provided additional background on historic presence of anadromous species in the upper Klamath River basin.

2. *Comment:* Complete removal or significant reduction in number of cattle from priority stream reaches in the Sycan River core area and the North Fork Sprague River and South Fork Sprague River is needed to improve riparian and instream habitats.

Response: We have added text to the background information presented in the *Factors Affecting Bull Trout in the Klamath Recovery Unit* section of the Plan to address the reviewer comment. We note that priority stream reaches for improved grazing management are identified for each core area in the *Recovery Measures Narrative* section of the Plan.

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September 2015