INTRODUCTION

Recovery Unit Designation

The Hood River Recovery Unit is one of 22 recovery units designated for bull trout in the Columbia River Distinct Population Segment (Figure 1). Designation of the Hood River Recovery Unit is based in part on the designation of bull trout in the Hood River Basin as a Gene Conservation Group by Oregon Department of Fish and Wildlife (ODFW 1995). The delineation of the Gene Conservation Group is supported by the genetic analysis conducted by Spruell and Allendorf (1997). There is one core area designated for the Hood River Recovery Unit, the Hood River Core Area (Figure 2). The Hood River Recovery Unit was further defined to include the Sandy River Basin as core habitat. Bull trout have only recently been discovered in the Sandy River, which is adjacent to the Hood River Basin, and there is insufficient information at present to determine the source of bull trout observed in the Sandy River, or define any local populations and their respective core areas.

The northwestern limit of the Hood River Recovery Unit extends to Bonneville Dam on the Columbia River. However, records of bull trout in the Bonneville reservoir, at Bonneville Dam, and immediately downstream of the dam indicate the possibility that bull trout from Hood River may be foraging and/or overwintering in the Columbia River. Further, three records of bull trout in the Sandy River indicate additional possibilities: (1) the Sandy River watershed supports a population of bull trout; or (2) bull trout foraging and/or overwintering in the Columbia River, possibly from the Hood River population, may occasionally be entering the Sandy River or other tributaries downstream of the Hood River Recovery Unit boundaries.

Figure 1. Bull trout recovery units in the United States. The Hood River Recovery
Unit is highlighted.

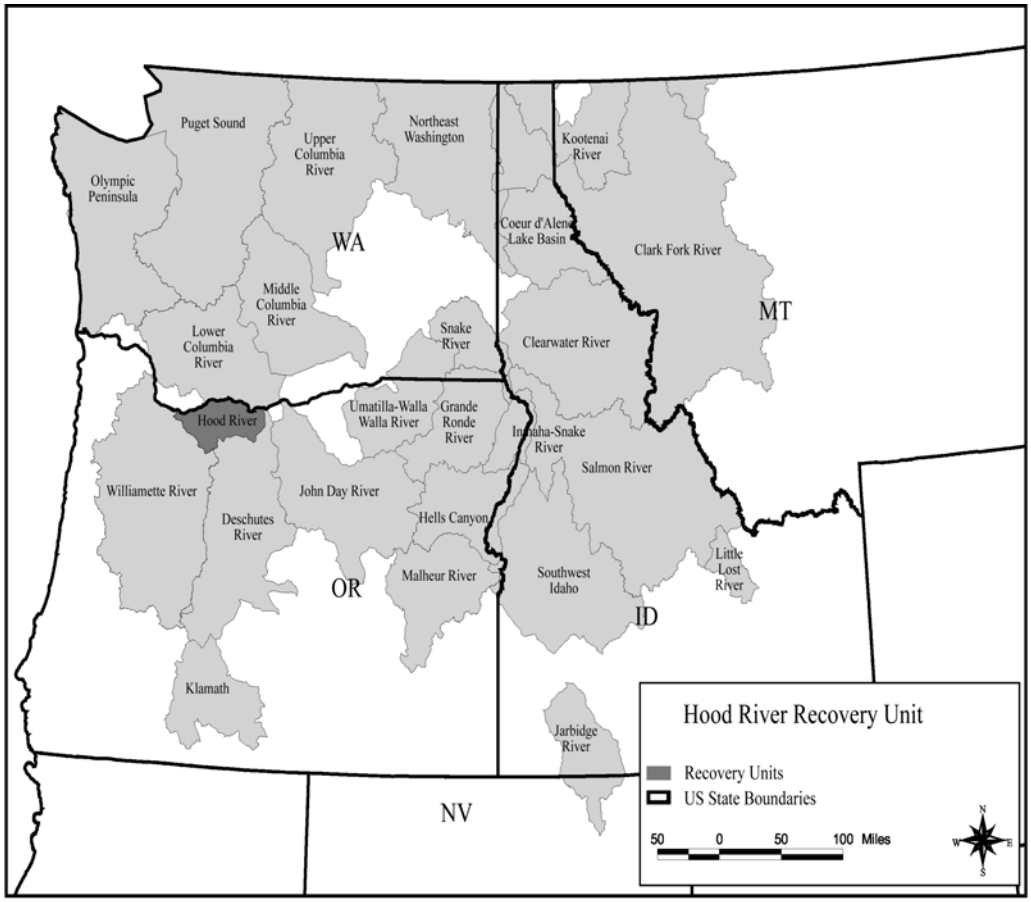
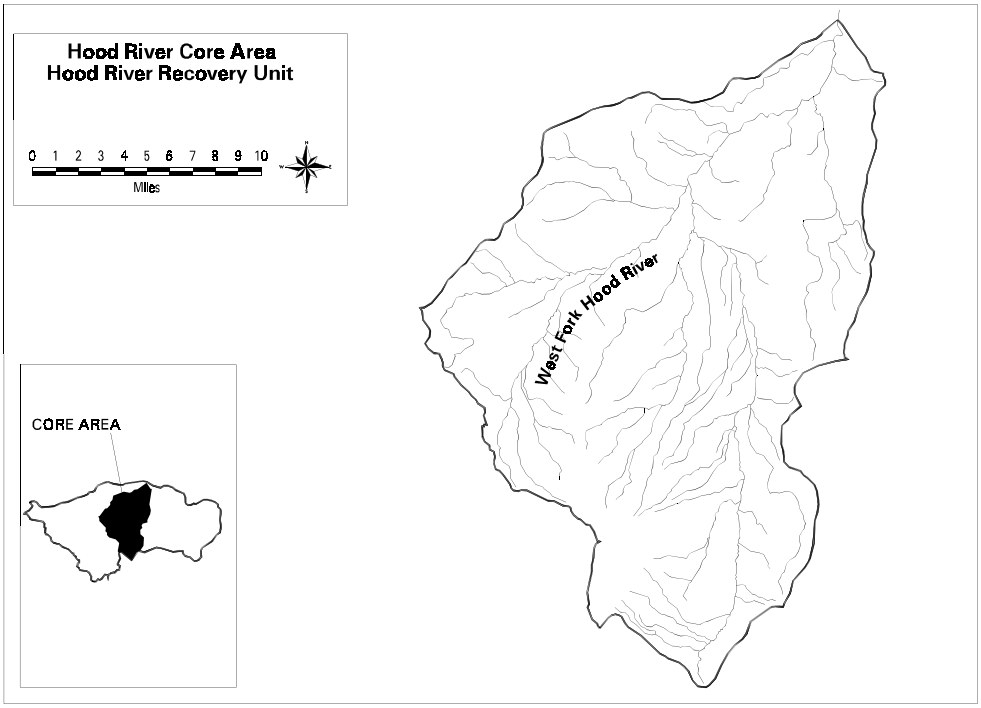


Figure 2. Map of the Hood River Bull Trout Recovery Unit, Hood River County, Oregon, with the core area delineated.



Geographic Description

Three major tributaries of the Hood River Basin, the East, Middle, and West Forks, originate on the eastern slopes of Mt. Hood, flow generally north, and converge to form the mainstem Hood River about 19.3 kilometers (12 miles) from the confluence with the Columbia River. The basin is defined by the Cascade mountain range to the west, the Sandy and White River drainages to the south, the Columbia River to the north, and Surveyor's Ridge to the east (Mosier, Mill, Threemile, Rock, and Fifteenmile Creek drainages). Basin elevations range from over 3,353 meters (11,000 feet) to about 23 meters (74 feet) at the confluence with the Columbia River. Of the approximately 1248 square kilometers (482 square miles) in the subbasin, about 881 square kilometers (340 square miles) are drained by the Hood River and its tributaries (Hood River Watershed Group (HRWG) 1999, Northwest Power Planning Council (NWPPC) 2000); the remaining 367 square kilometers (142 square miles) are watershed areas for tributary streams that drain directly into the Columbia River.

The Hood River Basin lies entirely within Hood River County, Oregon, with a 1999 population of about 19,000 people. Agriculture, tourism, and forestry are the primary industries. Approximately half of the land base is managed by the U.S. Forest Service, 6,880 hectares (17,000 acres) are in agricultural production, and over 20,235 hectares (50,000 acres) are privately-owned industrial forest lands (HRWG 1999, NWPPC 2000).

The Sandy River originates at an elevation of about 1,890 meters (6,200 feet) on the western and southwestern slopes of Mt. Hood and flows northwest approximately 89 kilometers (55 miles) to the confluence with the Columbia River. Its origins are in Clackamas County, Oregon, and it enters the Columbia River near the city of Troutdale in Multnomah County, Oregon. The Sandy River and associated tributaries drain an area of approximately 1316 square kilometers (508 square miles) (ODFW 1997).

The Hood River Basin is in a transition area between the moist marine flow characterizing the western slopes of the Cascades and the drier eastern slopes of the Cascades with a climate that is more continental in nature. Precipitation ranges from about 356 centimeters (140 inches) in the western portion of the watershed to about 76 centimeters (30 inches) on the eastern end. Much of this precipitation falls in the form of snow, particularly at higher elevations. Rain-on-snow events, with associated heavy runoffs, are not uncommon (HRWG 1999, NWPPC 2000).

The Sandy River basin lies to the west of the Cascade Mountain crest. Accordingly, the climate reflects the typical, moist maritime climate of western Oregon. Wet winters and snowfall amounts of up to 762 centimeters (300 inches) annually at the higher elevations of the western aspect of Mt. Hood are common. Snow and glacial melt influences water temperatures throughout the summer (ODFW 1997).

The Hood River Basin is a glacially influenced area of steep terrain, situated primarily on a volcanic bedrock formation of basalt and basaltic andesite. Glaciation and flooding have resulted in the formation of terraces of clay, silt, sand, and gravel at lower elevations (HRWG 1999, NWPPC 2000).

Similar to the Hood River, the Sandy River and its tributaries are influenced by glacial melt, steep terrain, and associated high stream gradients in the upper watershed. However, substrates in the upper reaches of the watershed are composed of loose alluvial rock, therefore high flows resulting from rain-on-snow events and glacial melt may affect channel configuration to a much greater degree than in the Hood River watershed. Below the confluence with the tributary Zigzag River the gradient is gradually more moderate until the confluence with the Columbia River (ODFW 1997).

All three tributaries to the mainstem Hood River receive some degree of glacial melt from Mt. Hood. The result is a steady supply of suspended sediment and bedload into the three forks and mainstem river, which is supplemented by periodic landslides and flooding, often prompted by rain-on-snow events. Many stream channels are moderate to high gradient in the upper reaches of the watershed, with generally decreasing gradients in the lower valleys. Stream channel substrates are typically boulder/rubble; channels are generally confined in narrow valleys (HRWG 1999, NWPPC 2000). The hydrology of the lower mainstem river is influenced by the Powerdale Diversion Dam and an associated water conveyance system running parallel to the river downstream to the Powerdale Powerhouse. A 4.8 kilometer (3- mile) reach of the river between river kilometer 2.4 and river kilometer 7.2 experiences reduced flows because of this diversion. Existing instream minimum flow requirements vary between 2.8 and 7.6 cubic meters per second (100 and 270 cubic feet per second). Proposed instream flow requirements associated with a new Federal Energy Regulatory Commission license vary between 4.0 and 7.1 cubic meters per second (140 and 250 cubic feet per second) (PacifiCorp 1998). Given that the license applicant has a 14.2 cubic meters per second (500 cubic feet per second) water right, and based on mean monthly flows from 1965 to 1993 (PacifiCorp 1998), the result is that under current operations approximately 29-82 percent of the instream flows are diverted to the water conveyance system, depending on the time of year. While the proposed instream minimum flows may represent an improvement relative to aquatic resources, reduced flows in general have the potential to negatively affect biological productivity, hydrological function, and other factors impacting aquatic resources (Ligon *et al.* 1995, Collier *et al.* 1997, Andrews 1986 *in* Montana Bull Trout Scientific Group 1998).

As indicated above, high flows resulting from rain-on-snow events and glacial melt may affect channel configuration in the upper reaches of the Sandy River watershed because of an erosion-prone substrate (loose alluvial rock). Below the confluence with the Zigzag River the gradient is reduced and the substrate is a combination of boulders, cobbles, and gravel over a basalt and sandstone foundation (ODFW 1997).

Fisheries. Fish species native to the Hood River watershed include fall chinook salmon (*Oncorhynchus tshawytscha*), summer and winter steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarki*), rainbow trout (*O. mykiss*), coho salmon (*O. kisutch*), Pacific lamprey (*Lampetra tridentata*), mountain whitefish (*Prosopium williamsoni*), sculpin (*Cottus sp.*), suckers (*Catostomus sp.*), northern pikeminnow (*Ptychocheilus oregonensis*), and bull trout. Native runs of spring chinook salmon and coho salmon are considered to be extirpated. Species from other watersheds that have been stocked include spring chinook, summer and winter steelhead, coho salmon, coastal cutthroat trout, and rainbow trout. Nonnative species currently residing in the watershed include brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and kokanee (*O. nerka*) (ODFW 1992, Busby *et al.* 1996, Nehlsen *et al.* 1991, USFS 1996a).

Steelhead, coho salmon, and spring chinook salmon are supplemented in the Sandy River watershed by hatchery production programs. Wild runs of these species, as well as native cutthroat and rainbow trout, whitefish, sculpin, and northern pikeminnow, also occupy the watershed. Nonnative introduced species include brook trout, shad (*Alosa sapidissima*), and carp (*Cyprinus carpio*) (ODFW 1997).

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

At the time of listing, the U.S. Fish and Wildlife Service identified two subpopulations of bull trout in the Hood River basin within the Middle Fork Hood River drainage: (1) Laurance Lake (upstream of Clear Branch Dam) and (2) Hood River (downstream of Clear Branch Dam and including tributaries). Historically, bull trout distribution included primarily the mainstem, Middle Fork and tributaries, and a short reach of the West Fork; and bull trout likely used the Columbia River for juvenile rearing and adult foraging (Buchanan *et al.* 1997). Punchbowl Falls is suspected to be a natural barrier to fish migration in the West Fork of Hood River during low flows; at the time of listing, only one bull trout had been captured at this location (Pribyl *et al.* 1996; Buchanan *et al.* 1997). Resident and migratory life history forms were identified above and below the Clear Branch Dam, and the total number of mature fish were believed to be below 300 individuals basin-wide (Buchanan *et al.* 1997).

Snorkel surveys of the Laurance Lake subpopulation detected 50 to 301 total bull trout annually from 1992 through 1996, including juveniles (Buchanan *et al.* 1997). Although upstream passage was recently provided by a trap at Clear Branch Dam, at the time of listing the U.S. Fish and Wildlife Service considered this subpopulation isolated until information was available on trap effectiveness; the trap has subsequently been found to be ineffective. The U.S. Fish and Wildlife Service considered this subpopulation at risk of stochastic extirpation due to its inability to be naturally reestablished, existence of a single spawning area, and low abundance.

Bull trout in the Middle Fork Hood River subpopulation are believed to spawn in Compass Creek and the Middle Fork Hood River (Buchanan *et al.* 1997). Nineteen fish with fork length greater than 200 millimeters (7.9 inches) were collected during surveys of Compass Creek in 1995 (Buchanan *et al.* 1997).

The U.S. Fish and Wildlife Service did not consider the Sandy River as bull trout habitat at the time of listing. At that time, there were no recent or historical

accounts of bull trout occurring in the Sandy River. Since the listing, bull trout have been sighted three times in the Sandy River.

Current Distribution and Abundance

Information on bull trout distribution and abundance in the Hood River Basin is from a variety of sources, and includes a number of sampling methods. Trap information is available from the Powerdale Dam trap, a trap on the Punchbowl Falls fish ladder (which was discontinued following the 1964 flood), floating screw traps at several locations throughout the basin, and a trap at the base of Clear Branch Dam. Other information has come from individual observations and snorkel and electrofishing surveys (see, for example, Pribyl *et al.* 1996).

Current bull trout distribution in the Hood River Recovery Unit occurs in five major areas within the basin: the Hood River, the East and West Fork of Hood River, the Middle Fork Hood River, and the Clear Branch of Hood River. Currently, bull trout are consistently found in only three of these areas, the Hood River, the Middle Fork Hood River, and the Clear Branch of Hood River. Bull trout distribution in the East and West Forks of Hood River are based on isolated, infrequent sightings. Historical distribution is believed to approximate current distribution based on existing knowledge. A comprehensive population assessment is not available, but at present the total number of adult bull trout in the recovery unit is believed to be less than 300.

Hood River Core Area. This core area includes the local populations defined as Clear Branch and Hood River. The Clear Branch local population is located above Clear Branch Dam, and includes bull trout in Laurance Lake and Pinnacle Creek. Most, if not all, of the current spawning activity occurs in Clear Branch upstream of Laurance Lake. The Hood River local population includes Clear Branch downstream of the dam, Bear, Coe, Compass, Tony, and Eliot Creeks, West Fork of Hood River and potentially Evans Creek and the East Fork Hood River.

Although confirmation is lacking for the East Fork Hood River and the number of observations is limited for the West Fork of Hood River, bull trout would

not have been precluded from using these tributaries historically, at least on a seasonal basis. Based on professional opinion, bull trout are believed to have occurred in the East Fork historically (USFS 1996a.). Analyses of East Fork tributary streams and stream segments for suitable bull trout habitat is not available at present. Bull trout are known from the West Fork of Hood River from two sightings, and U.S. Forest Service (1996b) identifies streams with suitable bull trout habitat based on temperature observations. Based on existing information, use of East and West Fork mainstems and tributaries appears to be for foraging, migration, and overwintering. According to Buchanan *et al.* (1997), William Stanley from the Middle Fork Irrigation District observed a bull trout in Evans Creek, a tributary to the East Fork Hood River, in the early 1990's. Subsequent survey of the area by a fisheries biologist did not yield any further detections (Buchanan *et al.* 1997). Small numbers of additional sightings are documented for the East Fork tributaries on Evans Creek and at the mouth of Wisehart Creek, again attributed to William Stanley (USFS 1996a). Bull trout in Evans Creek and the East Fork Hood River may be traveling through the irrigation canal which runs from Eliot Branch (a tributary to the Middle Fork Hood River known to contain bull trout) (USFS 1996a), or they may be attracted to Evans Creek from downstream, due to the addition of Eliot Branch water.

There are two records of bull trout occurrence in the West Fork of Hood River. The earliest available documentation is from 1963 of one fish in the trap at Punchbowl Falls fish ladder (USFS 1996b, Buchanan *et al.* 1997). Another bull trout was captured at the mouth of Lake Branch, a tributary to the West Fork of Hood River, in the fall of 1997 by the Oregon Department of Fish and Wildlife.

The mainstem Hood River is formed by the confluence of the Middle Fork and the East Fork. At present, this section of river is believed to be used primarily for foraging, migration, and overwintering. Migrations include journeys into the Columbia River of unknown extent, however, at least two bull trout tagged at the Powerdale Dam trap have been recovered in 1994 and 2000 at or near Drano Lake on the opposite side of the Columbia River in Washington State (Pribyl *et al.* 1996; ODFW, *in litt.* 2001) and another tagged in 1994 was captured in 1995, 11 kilometers downstream of the confluence of the Hood and Columbia Rivers

(Buchanan *et al.* 1997). Overwintering in the mainstem Hood River is suspected because untagged adult bull trout have been observed at several locations within the Hood River Basin (USFS 1996a) indicating they have not crossed the Powerdale Dam and upstream trap. There are no known spawning locations on the mainstem Hood River, and primary information on bull trout use of the mainstem is the trap data from Powerdale Dam.

Prior to 1992, trap counts at Powerdale Dam were not consistent due to counting at only one of the two ladders, or the ladders themselves being inoperable (USFS 1996a). Numbers of bull trout counted during this period range from a high of 12 in 1967, to a low of zero in 1970, and average five fish annually over the nine-year period (USFS 1996a). Bull trout have been trapped at the Powerdale Dam fish trap continuously since 1992 (Buchanan *et al.* 1997). Numbers trapped range from a high of 28 fish in 1999 to 2 fish in 1993. Table 1 below provides the number of bull trout trapped annually from 1992 to 2001.

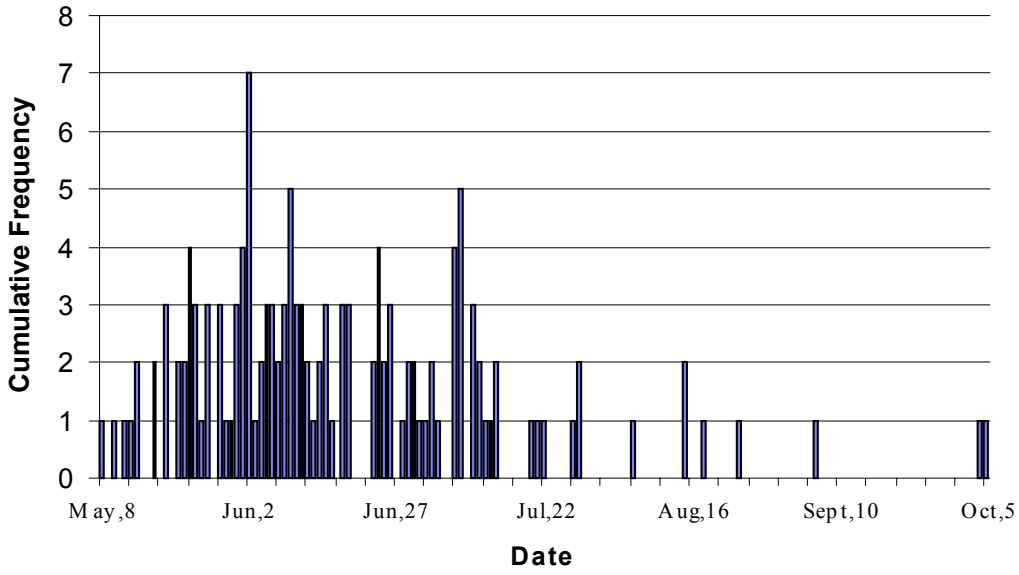
As shown in Figure 3, bull trout migrate upstream in the Hood River from the Columbia River through the trap from early May to early October. The primary movement period appears to be from mid-May to mid-July.

Bull trout in the Middle Fork Hood River use the mainstem Hood River primarily for foraging, migration, and overwintering. Spawning and likely most rearing occurs in tributary streams. Two redds were detected in Bear Creek in 1999 by personnel from the U.S. Forest Service (USFS, *in litt.* 1999). The location of these redds, were located approximately 100 meters upstream of the confluence with the Middle Fork, this suggests that rearing bull trout will occur in

Table 1. Number of bull trout trapped at the Powerdale Dam upstream fish trap, Hood River County Oregon, from 1992 to 2001.

Trap Year	Number Trapped
1992	6
1993	2
1994	11
1995	11
1996	18
1997	6
1998	18
1999	28
2000	27
2001	12

Figure 3. Cumulative frequency of bull trout trapped in the upstream fish trap at the Powerdale Dam, Hood River County, Oregon.



vicinity, including the Middle Fork Hood River, which was later verified by surveys (USFS, *in litt.* 1999). A bull trout was radio tracked into Tony Creek, a Middle Fork tributary in 1998 (USFS, *in litt.* 1999*)*. Rearing bull trout were observed in 1995 in Coe Branch and Compass Creeks by Oregon Department of Fish and Wildlife personnel (Buchanan *et al.* 1997), and one redd was found in Coe Branch in 1999 (USFS, *in litt.* 1999). At the Coe Branch diversion, six adult bull trout were passed manually above the diversion in 1995 (Pribyl *et al.* 1996). Bull trout have also been observed in Eliot Branch, even though swift water conditions inhibit adequate sampling above a diversion located in this reach (USFS, *in litt.* 1999). No population estimates are available for the Middle Fork Hood River and tributaries. Surveys in 1995 found 19 bull trout in Compass Creek (Buchanan *et al.* 1997). Snorkel surveys conducted in Compass Creek from 1995 through 1998 detected a high of 19 fish in 1995, two fish in 1996, zero fish in 1997 and one fish in 1998 (USFS, *in litt.* 1999).

Bull trout in the Clear Branch of Hood River occur primarily above the Clear Branch Dam. One redd was found on the lower Clear Branch (below the dam) in October 1999, the first since 1992. Above Clear Branch Dam, bull trout forage and overwinter in the reservoir and spawn in the tributaries (spawning suspected in Pinnacle Creek and known in Clear Branch above the reservoir). Table 2 provides the total number of juvenile and adult bull trout detected in snorkel surveys conducted in index reaches of Clear Branch above the reservoir, including 1999 data from a non-index survey. Bull trout observations in Pinnacle Creek include three juveniles and one adult from 1996 to 1998, one adult and one juvenile in 1999 (USFS, *in* litt. 1999), and four adults and two juveniles in 2001 (USFS, *in* litt. 2002).

Table 2. Observed adult and juvenile bull trout numbers in several survey reaches in the Clear Branch Hood River above Laurance Lake, Hood River County, Oregon (USFS, *in* litt. 2002; Pribyl *et* al. 1996). Night snorkel counts are indicated by an asterisk (*). In 1995, 2000, and 2001, both day and night snorkeling was conducted.

Year	Adults	Juveniles
1991 (partial survey)	>12	n/a
1992	21	61
1993	39	262
1994	8	42
1995	6	17 (55*)
1996	18	200*
1997	23	63*
1998	30	119*
1999 (index)	4	n/a
1999 (early count)	57	301
2000	14 (39*)	194*
2001	4 (34*)	185*

Sandy River Core Habitat. There have been three bull trout observations in the Sandy River. Anglers have caught and photographed two bull trout; one approximately 43 cm (17 inches) near the mouth of Gordon Creek in the vicinity of Oxbow County Park in November 1999 (NPPC 2000), and another approximately 51 cm (20 inches) between Oxbow and Dodge Parks on January 23, 2002. The third observation was by Oregon Department of Fish and Wildlife staff operating the trap at Marmot Dam, where they trapped and released a 46 cm (18 inch) fish upstream of Marmot Dam.

REASONS FOR DECLINE

At the time of listing, the U.S. Fish and Wildlife Service considered bull trout in the Hood River Basin to be threatened by isolation (from dams and seasonally impaired water quality) and impacts to stream systems from past and ongoing forest management and agricultural activities. Bull trout above Laurance Lake in the Clear Branch of Hood River were considered to be at risk of a random extinction event due to low numbers, isolation, and restriction to a single known spawning area (USFWS 1998). At the time of listing, there were no current or historical records of bull trout occurring in the Sandy River, so threats and factors for decline were not identified in the Sandy River basin.

Dams

Existing and abandoned dams contribute to reduced migration and isolation of bull trout in the Hood River basin and are believed to be a major limiting factor (Buchanan *et al.* 1997). According to the Hood River Working Group (HRWG 1999), the use of water to operate saw mills, and dam and mill pond construction began in 1861. The Hines Lumber Company Dam was constructed on the mainstem Hood River in the early 1860's, and was at minimum, a periodic barrier to fish migration until its removal in 1966 (Newton and Pribyl 1993, Pribyl *et al.* 1996, Buchanan *et al.* 1997, USFS 1996a, HRWG 1999). Water used for hydropower production is the largest non-consumptive use of water in the Hood River Basin, and the total volume of all legal water rights for out-of-stream uses is approximately 94 percent of the median natural stream flow at the mouth of the Hood River (HRWG 1999).

Powerdale Dam, on the mainstem Hood River, was constructed in 1909 (USFS 1996a). Although a fishway and upstream trap were installed during the original construction, they continue to be a migratory impediment by allowing only some fish passage to occur upstream (Newton and Pribyl 1993, Pribyl *et al.* 1996, USFS 1996a, HRWG 1999). The Powerdale Dam diversion is the largest in the Hood River basin and holds the largest water right, allowing PacifiCorps to divert up to 14.2 cubic meters per second (500 cubic feet per second), (HRWG 1999).

Water diverted for power production may, at times, occur in sufficient amounts to preclude fish passage in the lower 5.2 kilometers (3.2 miles) of stream channel between the powerhouse and dam (USFS 1996a). Additionally, greater spill volume from the project at the west bank may mask attraction flow to the fish ladder, encouraging fish away from the ladder entrance (HRWG 1999). The inadequately screened diversion channel entrains downstream migrating fish, potentially trapping them in the penstock (USFS 1996a). The bypass reach is also identified as exceeding Federal Clean Water Act Section 303(d) standards for pH and temperature (ODEQ 2001).

Clear Branch Dam, constructed in 1969 without fish passage, isolated bull trout above and below the dam. The resulting reservoir partially inundated bull trout spawning habitat, as well as possibly the most productive coho and steelhead spawning areas in the entire Middle Fork Hood River watershed (USFS 1996a). The dam isolates the upper 4.5 kilometers (2.75 miles) of the Clear Branch Hood River from the rest of the Hood River basin and isolates Pinnacle Creek in its entirety (USFS 1996a). An upstream fish trap was installed at the facility in 1997, allowing fish to be passed above the dam, but only one fish has been passed upstream in 1997, and the trap presently is not effective for capturing bull trout. The outlet on the dam may entrain bull trout into the pressurized pipe system due to inadequate screening (Pribyl *et al.* 1996). Clear Branch Dam also prevents natural movement of stream sediments, which is important to maintaining adequate spawning conditions in Clear Branch below the dam and the Middle Fork Hood River. The relatively warm impounded waters increase stream temperatures below the dam beyond those suitable for bull trout at certain times of the year (Buchanan *et al.* 1997). The Clear Branch of Hood River (from its mouth to Clear Branch Dam), and the Middle Fork Hood River (from its mouth to the Clear Branch confluence) are currently listed as violating Federal Clean Water Act section 303(d) standards for temperature (ODEQ 2001).

Cloudy (discolored) eyes have been noted occurring on bull trout captured at Powerdale Dam. One possibility is damage from gas supersaturation. Dissolved gas levels need to be evaluated at both dams to identify potential impacts, if any.

Forestry Management Practices

Approximately 50 percent of the Hood River Basin is managed by the U.S. Forest Service, and commercial forest operations are also a major land use on non-Federal lands within the basin (NWPPC 2000). Hood River County manages 30,000 acres as industrial forest and 22,000 acres of private lands are owned and managed by the Longview Fiber Company within the basin (HRLAC 2001). Intensive logging of the lower valley and gorge areas occurred in the early 1900's, both for lumber production and to clear land for agricultural production, primarily orchards, (USFS 1996a). Area streams were dammed to power sawmills, and mill ponds were created at several locations as early as 1861; Neal and Green Point Creeks, the mainstem Hood River, and lower East Fork Hood River were indicated as supporting this activity (HRLAC 2001). The most important fisheries issue identified by the U.S. Forest Service (1996a) in the watershed analysis for the Middle and East Forks of Hood River was the loss of large wood from streams, and the future large wood recruitment potential from the adjacent riparian areas.

In addition to the relatively permanent dams constructed to store and process trees into lumber, the practice of splash damming streams to transport trees to sale or processing points is described as being common within the Hood River in the early to mid-1900's (NWPPC 2000). This activity involved building a temporary dam to impound water, cutting the surrounding forest and skidding the trees into the impoundment, and then releasing the flow all at once to transport the trees downstream. The results to streams and riparian zones, as well as fish and any wildlife in the immediate area, were cataclysmic; the slurry of water and trees wiping out any obstacle in the path of the flood flow. Stream habitat and levels of large wood remain inadequate and have not recovered in many locations due to this practice (NWPPC 2000).

Forest harvesting on Federal lands increased during the period between 1950 and 1980, with the most extensive harvest and road building activity occurring in the Tony and Bear Creek areas within the Middle Fork Watershed (USFS 1996a). Another practice common with forest harvest until the early 1980's was the removal of large wood from streams (USFS 1996a) in a mistaken attempt to improve fish passage, which has led in part to the observed deficit of large wood in stream channels.

The Clear Branch of Hood River was heavily logged prior to construction of the Clear Branch Dam in 1969 (Buchanan *et al.* 1997). Wildfire in the late 1800's followed by salvage logging from 1954 to 1957 in the Clear Branch drainage was responsible for removing much of the riparian vegetation along Clear Branch for the majority of its length, resulting in a deficiency of large wood in the Clear Branch (Pribyl *et al.* 1996), and delaying recruitment of large wood through natural processes.

The West Fork of Hood River has been destabilized in parts of the watershed due to elevated forest harvest rates and associated road building activity (HRWG 1999). The relatively high rate of debris torrents in the West Fork compared to other areas of the Mount Hood National Forest, are associated with clearcuts and roads (HRWG 1999). Large harvest tracts (2970 hectares, 7340 acres), and extensive fires from mill or logging fire ignitions accompanied railroad logging of the West Fork of Hood River in the early 1900's (USFS 1996b.).

Current management of National Forest lands within the Mount Hood National Forest is specified, in part, by the Northwest Forest Plan. This plan has set up land allocations that are protective of certain groups of species and habitat conditions, and established an aquatic conservation strategy that applies in addition to allocation-based standards and guidelines. If adequately implemented, this strategy should allow constant improvement of stream systems subject to the influence of management activities on the National Forest.

Livestock Grazing

Euro-American settlement of the Hood River Basin began in 1880, and included sheep and cattle grazing in the upper watersheds, in meadow and forested areas (USFS 1996a). The Hood River Local Advisory Committee (HRLAC 2001) indicates that grazing use by sheep and cattle was common on the upper slopes of the East Fork Hood River prior to 1900. Although sheep herding and cattle grazing were banned following establishment of the Cascade Range Forest Reserve in 1893, these activities continued until after 1900 (USFS 1996a). Currently in the Hood River Basin, 809 hectares (2,000 acres) are actively irrigated for pasture, with the majority of livestock operations occurring on farms less than 8 hectares (20 acres) in size (HRLAC 2001). While livestock grazing can cause serious damage to stream and riparian systems, the extent and location of livestock grazing activities are not sufficient to be considered a substantial threat to bull trout in the Hood River Basin. However, the Northwest Power Planning Council (2000) indicates that a proposal is being developed that includes funding the construction of 1.6 to 8.0 kilometers (1 to 5 miles) of fencing along the East Fork Hood River or its tributaries to prevent livestock from accessing the riparian zone, to help control agricultural pollution. Since the full extent of bull trout use of the East Fork is currently unknown, impact from livestock grazing in this area is currently not considered an issue. However, in the future it may be determined to have some effect on bull trout recovery if current or potential use of the East Fork Hood River is judged to be greater.

Agricultural Practices

As noted above in the section on Forest Management, one impact of agricultural systems in the Hood River Basin has been the loss of forest cover and its attendant values and functions such as stream shade, contributions of large wood to stream channels, bank stability, and attenuating landslides, debris flows, or glacial outbursts. (USFS 1996a). In addition to the loss of forest cover and streamside vegetation, many wetlands were drained and many streams were diverted as agriculture progressed up the valley (HRLAC 2001). The growth of the fruit industry may have been the largest factor altering natural vegetation patterns in

the lower Hood River Basin, with orchards replacing native forest and riparian vegetation (HRLAC 2001). According to the USFS (1996a, *citing* the Oregon State Game Commission 1963), two fish kills occurred in 1963 that were attributed to insecticide or herbicide use in Hood River Basin orchards. State and Federal water quality standards were exceeded in the spring of 1999 for the insecticides chlorpyrifos at Neal Creek and Indian Creek, and azinphos methyl at Neal Creek, Indian Creek, and the lower Hood River (NWPPC 2000). Herbicide, insecticide, and fungicide use in the Hood River Valley included the use of up to 43 different compounds in 1987 (USDA 1996a).

Five irrigation districts and one irrigation company operate in the Hood River Basin: East Fork, Mount Hood, Middle Fork, Dee Flat, and Farmers irrigation districts and the Aldridge Irrigation Company have combined water rights of 14.15 cubic meters per second (499.52 cubic feet per second) (HRWG 1999). In 1991, the total amount of irrigated area in the Hood River Valley was approximately 10,000 hectares (23,720 acres) (USFS 1996a). Several diversion structures may impede bull trout passage due to flow reduction below the diversions or potentially entrain juveniles or adults into the irrigation works due to inadequate screening (Pribyl *et al.* 1996, HRWG 1999). These structures include: the Eliot Branch (passage and screening) and Coe Branch (passage and screening) diversion structures operated by the Middle Fork Irrigation District, and the Farmers Irrigation District diversion (screening) on the mainstem Hood River (HRWG 1999). The Middle Fork Hood River, Indian Creek, Lake Branch Hood River, and Neal Creek are indicated by the Oregon Department of Environmental Quality (ODEQ 2001) as violating clean water standards for temperature, which is, in part, related to flow reduction due to water withdrawal for agriculture, and irrigation return flow (ODEQ 2001).

As described above, the area affected by agricultural activities is mainly along the lower (north) portions of the Hood River Basin. Degraded water quality from these activities at present does not occur in proximity to known spawning areas, but instead is more likely to influence existing migratory corridors, such as the Middle Fork and mainstem Hood River, and may impact bull trout recovery in the future. Direct impacts at present are attributed to inadequate screening at

diversion points, flow reduction and elevated water temperatures due to water withdrawal from stream channels, and a passage barrier at the Coe Creek diversion structure. Passage at the Eliot Branch diversion is a lower priority following the November 1999 glacial outburst, which filled a substantial portion of the stream channel with boulder-sized material that precludes bull trout use of most of Eliot Branch. Agricultural practices have altered Neal Creek through channelization and bank stabilization that confine the stream and isolate it from the floodplain (ODEQ 2001).

Transportation Networks

As with many stream systems throughout the Pacific Northwest and the country, extensive road networks may parallel existing stream channels exerting a variety of impacts, such as increased sediment loading from gravel or native surface roads, intercepting surface and shallow subsurface water flow and altering runoff patterns, and constraining stream channels from normal movement and adjustment patterns, among other impacts. Landscape analysis correlating road density to the status of four non-anadromous salmonids indicated that increasing road densities had a strong negative correlation with the status of the particular salmonid species (Lee *et al.* 1997). According to Lee *et al*. (1997) bull trout were generally found to be absent where geometric mean road densities were greater than or equal to 0.7 kilometers per square kilometer (1.13 miles per square mile) and the arithmetic mean road density of all upstream subwatersheds was 1.06 kilometers per square kilometer (1.71 miles per square mile).

The East Fork Hood River and Neal Creek have been severely affected by transportation corridor development in the Hood River Basin (ODEQ 2001). In particular State Highway 35 is considered a significant and chronic impact to the East Fork Hood River, and road construction and agricultural practices have altered Neal Creek through channelization and bank stabilization that confines the stream and isolates it from the floodplain (ODEQ 2001). The average road density of subwatersheds in the East Fork Hood River is 1.32 kilometers per square kilometer (2.14 miles per square mile), while Evans Creek has a road density of 2.99

kilometers per square kilometer (4.87 miles per square miles), well above thresholds noted for bull trout.

A Forest Service road paralleling Clear Branch of Hood River altered hydrology, constrained stream movement and contributed sediment to the Clear Branch, where bull trout spawn and rear (Pribyl *et al.* 1996). The road was blocked in 1995 and portions of it were obliterated (the upper 1.9 kilometers (1.2 miles) were obliterated in 1989, and another 0.8 kilometers (0.5 miles) were obliterated in 2000 and 2001) in an effort to reduce impacts to the stream system (Pribyl *et al.* 1996). Additionally, several culverts have been removed from Pinnacle Creek, one near the confluence with Laurance Lake (replaced with a bridge) and another further up Pinnacle Creek.

Roads and management-related debris flows account for the majority of fine sediment production in the West Fork of Hood River watershed (USFS 1996b). Road segments that pose chronic maintenance problems are identified for the West Fork of Hood River in U.S. Forest Service (1996b). The Oregon Department of Transportation and the Oregon Department of Fish and Wildlife compiled a list and maps of known fish passage problems in the Hood River Watershed, including culverts at road crossings (NWPPC 2000). According to the U.S. Forest Service (1996a) the Bear, Evans, Tony, and Trout Creeks, and the East Fork of Hood River have relatively high road densities that expand the drainage network by intercepting subsurface and overland flow, resulting in increased erosion and delivery of fine sediment to area streams. Many of the East Fork Hood River tributaries carry high loads of glacial sediments, potentially masking the effect of road-related sediment delivery (USFS 1996a).

Mining

Rock and gravel mining appear to be the main and possibly only sizeable mining activities in the Hood River Basin (USFS 1996a and b). This activity does not appear to be a significant limiting factor in bull trout survival or recovery at this time, although remediation of existing sites to reduce erosion would improve stream conditions at several locations (NWPPC 2000).

Residential Development and Urbanization

Hood River County covers the majority of the Hood River basin. Portions of Multnomah and Wasco Counties also occur within the basin. According to the Oregon Department of Environmental Quality (ODEQ 2001), population within the county in 2000 was 20,411 people, and mainly dispersed from the small urban centers of Hood River, Cascade Locks, Odell, and Parkdale. (70 percent of the residents live outside these areas, which represent approximately four percent of the basin). Municipal and Industrial water demands are met through water rights administered by six entities: the City of Hood River, Crystal Springs Water District, Ice Fountain Water District, Parkdale Water Company Incorporated, Odell Water Company, and City of the Dalles (HRWG 1999). These entities hold water rights totaling 1.3 cubic meters (46 cubic feet per second) of flow plus the City of The Dalles water right that allows it to take all the available flow of the Dog River, which is in the range of 0.08 to 0.3 cubic meters per second (three to 12 cubic feet per second) (HRWG 1999). Given the relatively small increment of flow for municipal and industrial uses versus agricultural use, small size of urban centers, and their location away from bull trout local populations, residential and urban development do not pose a substantial threat to bull trout at present in the Hood River Recovery Unit.

Fisheries Management

There have been numerous occurrences of fish stocking in the Hood River Basin. According to Pribyl *et al.* (1996), juvenile steelhead were the first hatchery fish released into Laurance Lake. Brook trout have not been intentionally stocked or introduced into the Middle Fork Hood River at present, but they have been released for many years in other parts of the basin (Pribyl *et al.* 1996). Smallmouth bass (*Micropterus dolomieu*) have been found in Laurance Lake, the result of an unauthorized introduction. Unauthorized fish introduction is a significant problem in all the State's waters. The Oregon Department of Fish and Wildlife has ceased all brook trout stocking in the Hood River basin (Pribyl *et al.* 1996). The Oregon Department of Fish and Wildlife began to change bull trout harvest regulations in the Hood River in 1991, due to concerns with the status of bull trout (Pribyl *et al.*

1996). Angling was closed in the Clear Branch Hood River above and below the Clear Branch Dam and Pinnacle Creek in 1994 (Pribyl *et al*.1996). Bull trout may not be legally harvested in any stream within the Hood River basin, and fishing in some streams is restricted to artificial flies and lures, which reduces potential hooking damage compared to fishing with bait.

The Confederated Tribes of the Warm Springs Reservation hold federally-reserved fishing rights in the Columbia River and the Hood River watershed. The Confederated Tribes of the Warm Springs Reservation co-manage the fishery resources in the watershed with the Oregon Department of Fish and Wildlife. The Oregon Department of Fish and Wildlife and the Confederated Tribes of the Warm Springs Reservation jointly implement the Hood River Production Program to (1) establish a naturally self-sustaining spring chinook salmon population using Deschutes River stock; (2) rebuild runs of summer and winter steelhead using native broodstock; (3) maintain the genetic characteristics of the wild salmonid populations; (4) restore degraded habitat; and (5) contribute to harvest opportunities. Monitoring facilities include an adult trap at Powerdale Dam and six screw traps that are seasonally deployed to monitor juvenile outmigrants. Carcasses of spawned salmonid broodstock are distributed, which benefits the food chain, and numerous habitat improvement projects have been implemented to address the effects of riparian and channel degradation and water diversions (ODFW 1992, HRWG 1999).

Isolation and Habitat Fragmentation

Isolation and habitat fragmentation mechanisms have been previously discussed under dams and agricultural practices above. The main structures in the Hood River Basin isolating bull trout are Powerdale and Clear Branch Dams (Buchanan *et al*. 1997). Irrigation diversions at Coe Branch, and Eliot Branch were not screened until 1988, and upstream passage is incorporated into the Coe diversion only (USFS 1996a). Farmers irrigation diversion on the mainstem is presently undergoing modification to its screening system to prevent juvenile salmonid entrainment, but may seasonally impede passage due to the volume of water diverted, 2.5 cubic meters per second (90 cubic feet per second). Dee

diversion on the west fork has adequate screening for juveniles, but may impede upstream passage (ODFW, *in litt*. 2001). The Tony Creek diversion is inadequately screened, and has no passage capabilities (ODFW, *in litt*. 2001).

It is important to note that periodic high magnitude disturbance events, such as glacial outbursts, are relatively frequent in the Hood River, emphasizing the need for more numerous, well distributed local populations. Well distributed local populations are essential to spread the risk of high magnitude natural events among more abundant local populations rather than the few that presently exist.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Efforts to recover anadromous species are ongoing in the Hood River Basin with a high level of cooperation between fishery entities on various projects. Spawning surveys have been a cooperative effort for many years. The Hood River basin has an active local watershed group dedicated to finding workable solutions to restoring native fish runs.

Oregon Department of Fish and Wildlife has a number of ongoing efforts to conserve bull trout. The department has reduced or eliminated brook trout stocking programs, adopted changes in angling regulations to prohibit take of bull trout, modified regulations on other fisheries to reduce incidental take, made changes to in-water work periods to better address bull trout needs, developed and distributed bull trout identification posters, and hired a bull trout coordinator in 1995 to complete statewide bull trout status assessment, map bull trout distribution, and develop conservation strategies for bull trout. When bull trout were listed the coordinator's effort shifted to recovery planning. Oregon Department of Fish and Wildlife also receives funding through a Section 6 cooperative agreement with the U.S. Fish and Wildlife Service, which has helped support spawning surveys for bull trout.

Oregon Department of Fish and Wildlife, the Confederated Tribes of the Warm Springs Indian Reservation, and U.S. Forest Service staff work cooperatively to gather conservation information and implement habitat restoration projects for bull trout.

The U.S. Forest Service also has a number of ongoing efforts to conserve bull trout. The U.S. Forest Service has developed and distributed bull trout conservation materials and identification posters in areas of recreation use where bull trout occur, has implemented a number of habitat restoration projects in the Clear Branch of Hood River, has removed culverts from Pinnacle Creek, replaced a culvert stream crossing with a bridge span near the mouth of Pinnacle Creek, has removed problem road segments along the Clear Branch of Hood River and Pinnacle Creek, and remediated a rock quarry near the Clear Branch of Hood River.

Oregon Department of Fish and Wildlife, has also conducted numerous anadromous fish, stream habitat and research projects in the Hood River Recovery Unit, that have been funded by the Bonneville Power Administration.

The U.S. Forest Service has also completed two watershed analyses that provide information important in planning additional conservation activities in the Hood River Basin. Federal lands within the basin managed under the Mt. Hood National Forest Land and Resource Management Plan are covered by a provision of the Northwest Forest Plan which amends the management plan in this area. This includes complying with an aquatic conservation strategy which includes riparian reserves, a network of key watersheds, watershed analysis, and watershed restoration as major components.

The U.S. Forest Service and the Oregon Department of Fish and Wildlife operate fish traps at Clear Branch and Powerdale Dams that are important sources of information on fish movement, numbers, and age and growth. Information from these traps provides a conservation benefit for bull trout.

Other ongoing conservation efforts include, the placement of spawning gravel below Clear Branch Dam funded by the Middle Fork Irrigation District in an effort to augment the amount of available gravel; development of a basin assessment, a draft subbasin summary, and a draft watershed action plan providing conservation planning information led by the Hood River Watershed Group; completion of the Western Hood Subbasin TMDL process for water temperature in December 2001, and completion of the Hood River Agricultural Water Quality Management Plan in February 2001.

RELATIONSHIP TO OTHER CONSERVATION EFFORTS

State of Oregon

On January 14, 1999, Governor Kitzhaber expanded the Oregon Plan for Salmon and Watersheds (ODFW 1997) to include all at-risk wild salmonids throughout the State through Executive Order 99-01. Its goal is to "restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits." Components of this plan include (1) coordination of efforts by all parties, (2) development of action plans with relevance and ownership at the local level, (3) monitoring progress, and (4) making appropriate corrective changes in the future. It is a cooperative effort of State, local, Federal, tribal and private organizations, and individuals.

Oregon Department of Fish and Wildlife and Oregon Water Resources Department have established priorities for restoration of streamflow as part of the Oregon Plan for Salmon and Watersheds (Measure IV.A.8). Oregon Department of Fish and Wildlife has prioritized streamflow restoration needs by ranking biophysical factors, water use patterns, and the extent that water limits fish production in a particular area. Oregon Water Resources Department watermasters will incorporate the priorities into their field work activities as a means to implement flow restoration measures. The needs priorities will be used by the Oregon Watershed Enhancement Board as one criterion in determining funding priorities for enhancement and restoration projects. Watershed councils and other entities may also use the needs priorities as one piece of information to determine high priority restoration projects. Bull trout occupied streams in the recovery unit are included in the highest priority designation for streamflow restoration (NWPPC 2000).

Opportunities to convert existing out-of-stream flows to instream flows in Oregon are available through a variety of legislatively mandated programs administered by Oregon Water Resources Department, for example: transfers of type and place of use (ORS 536.050(4)); voluntary written agreement among water users to rotate their use of the supply to which they are collectively entitled (ORS

540.150 and OAR 690-250-0080); allocating "conserved water" to instream use (ORS 537.455 to 537.500); leasing all or a portion of consumptive water rights to instream purposes (ORS 537.348, OAR 690-77-070 to 690-77-077); exchanging water rights for instream purposes using water from a different source, being stored, water, surface, or ground water (ORS 540.533 to 540.543)or and substituting a ground water right for a primary surface water right (ORS 540.524). Oregon Water Trust purchases water rights from willing land owners for conversion to instream water rights.

Through the Western Hood Subbasin TMDL process, an Agricultural Water Quality Management Plan was developed to address agricultural sources of water quality impairment. The Agricultural Water Quality Management Program, established through the Senate Bill 1010 process (ORS 568.900 through 568.933), addresses water pollution associated with agricultural lands and activities. An agricultural water quality management area plan was completed for the Hood River basin in 2001 (HRLAC 2001).

Confederated Tribes of the Warm Springs Indian Reservation

The Confederated Tribes of the Warm Springs Reservation hold federally-reserved fishing rights in the Columbia River and the Hood River watershed. The Confederated Tribes of the Warm Springs Reservation co-manage the fishery resources in the watershed with the Oregon Department of Fish and Wildlife. The Oregon Department of Fish and Wildlife and the Confederated Tribes of the Warm Springs Reservation jointly implement the Hood River Production Program to (1) establish a naturally self-sustaining spring chinook salmon population using Deschutes River stock; (2) rebuild runs of summer and winter steelhead using native broodstock; (3) maintain the genetic characteristics of the wild salmonid populations; (4) restore degraded habitat; and (5) contribute to harvest opportunities. Monitoring facilities include an adult trap at Powerdale Dam and six screw traps that are seasonally deployed to monitor juvenile outmigrants. Carcasses of spawned broodstock are distributed to benefit the food chain, and numerous habitat improvement projects have been implemented to address the effects of riparian and channel degradation and water diversions (ODFW 1992;

HRWG 1999). Many of these efforts will also contribute to the recovery of bull trout.

Local Planning Efforts

The Hood River Watershed Group has been active for a number of years, and is chartered as a watershed council under the Oregon Plan. The group has compiled a number of watershed planning documents including the draft Hood Subbasin Summary for the Northwest Power Planning Council, the Hood River Watershed assessment, and more recently a public review draft of the Hood River Watershed action plan.

Northwest Power Planning Council's Subbasin Planning

As part of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, the Bonneville Power Administration has the responsibility to protect, mitigate and enhance fish and wildlife resources affected by operation of Federal hydroelectric projects in the Columbia River and tributaries. The Northwest Power Planning Council develops and implements the Columbia River Basin Fish and Wildlife Program that is implemented by the Bonneville Power Administration, U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and Federal Energy Regulatory Commission. Coordination of Bonneville Power Administration's responsibilities for protection, enhancement, and mitigation and incorporation of recommendations by Northwest Power Planning Council is in part done through the development of subbasin summaries , which identify status of fish and wildlife resources, limiting factors, and recommended actions at the subbasin level.

The draft Hood River Subbasin Summary (NWPPC 2000), encompasses the Hood River Recovery Unit, and is consistent with bull trout recovery planning efforts to identify limiting factors. The draft subbasin summary identifies elevated water temperature, altered channel conditions, reduced instream habitat diversity, altered flow, altered riparian habitat condition, and passage barriers as factors contributing to the decline of bull trout. The overall fisheries goal of the draft Hood River subbasin plan is to "Protect, enhance and restore wild and natural populations

of anadromous and resident fish within the Hood River Subbasin." According to the subbasin plan this goal will be achieved by the year 2016 or earlier. The Hood River Recovery Unit team will continue to utilize this planning process to identify and seek funding for projects to aid bull trout recovery.