Chapter 1 – History, Status, and Draft Recovery Plan Guidance for Bull Trout in the Clackamas River Subbasin

1.1 Introduction

This assessment investigates the feasibility of reintroducing bull trout (*Salvelinus confluentus*) into the Clackamas River Subbasin, a tributary of the Willamette River (Figure 1. 1). Bull trout were a historic component of the native fish assemblage in the Clackamas River, but they are now locally extirpated (Buchanan et al. 1997, Ratliff and Howell, 1992). Although bull trout are presently widespread within their historic range in the coterminous United States, they have declined in overall distribution and abundance during the last century (USFWS 2002), and they were listed in 1998 as threatened under the federal Endangered Species Act (ESA).

For the past two decades, local fish biologists have informally discussed the possibility of reintroducing bull trout into the Clackamas River Subbasin. In 2004, the Clackamas River Bull Trout Working Group (CRBTWG) began exploring this more formally. Many fish species reintroductions have occurred throughout the United States without a thorough assessment or documented plan. Many of these efforts were unsuccessful and in most cases there was insufficient documentation to evaluate these failed attempts (Williams et al. 1988).

This assessment represents a collaborative, comprehensive examination of the various factors involved in determining whether or not a bull trout reintroduction into the Clackamas River is feasible. Inevitably, it is easy to jump ahead to the various factors and issues involved in contemplating a potential reintroduction of bull trout into the Clackamas River. Some of these factors and issues include which is the best donor stock, where should bull trout be released, what method of translocation should be used, and what are the ecological impacts of reintroduction? The authors have focused this assessment specifically on the biological feasibility of reintroduction – that is, "Can a reintroduction of bull trout into the Clackamas River be done?" This specific focus thereby determines the scope of this feasibility assessment. This assessment, itself, does not attempt to determine "Should a reintroduction be done?" or "How should it be done?" Once the feasibility of a reintroduction is established, only then can a proposed action be developed in coordination with multi-agency policy and decision-makers to investigate the latter two questions further through administrative and regulatory procedures. It is imperative that reviewers of this assessment understand its breadth and scope. The authors of this assessment explore, in detail, all of the facets of the first and most fundamental question: "Can a reintroduction of bull trout into the Clackamas River be done?" The assessment answers this question and goes further to provide valuable baseline information that would be useful in addressing the latter two questions, should a reintroduction effort be pursued.

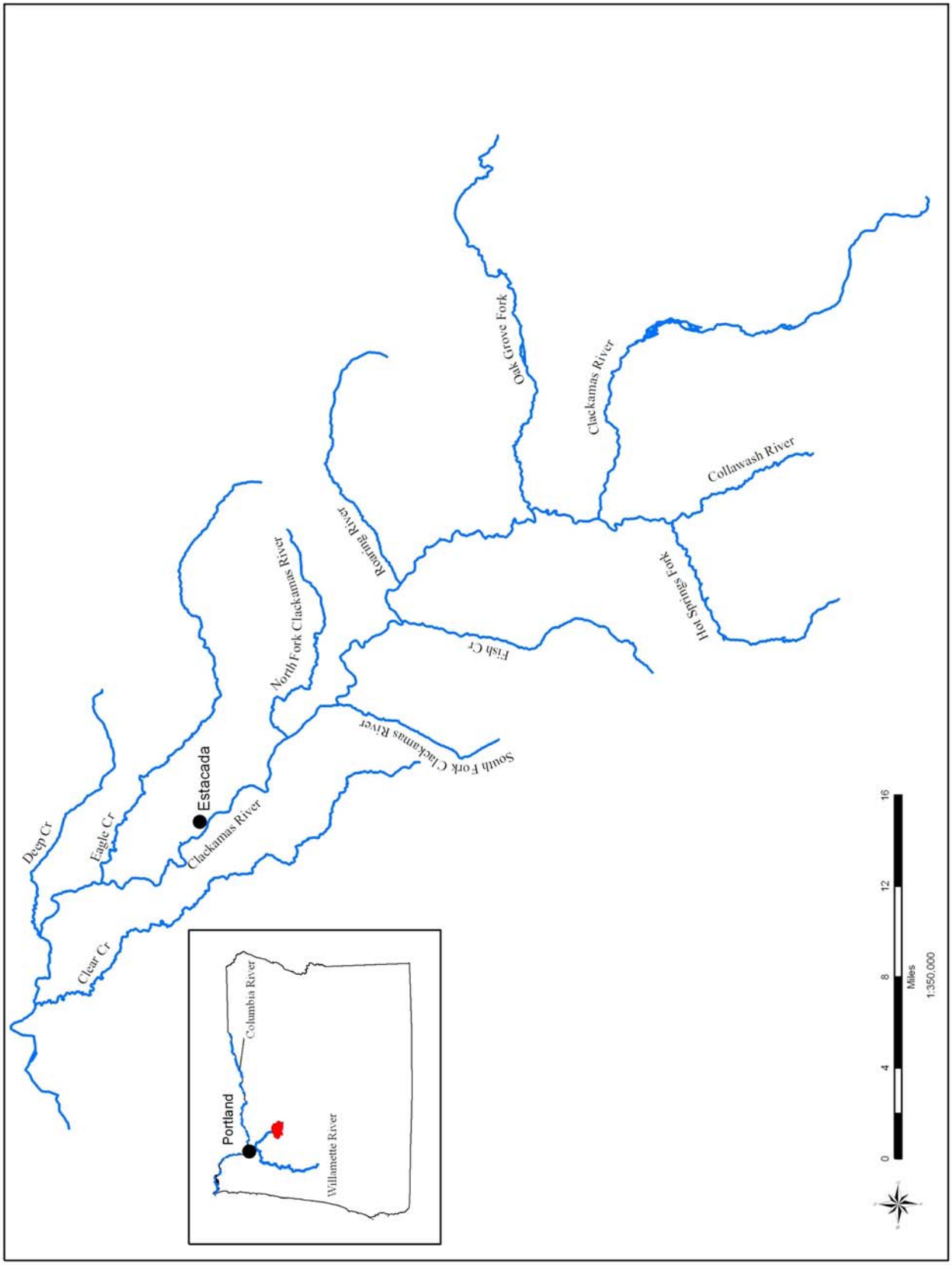

Figure 1. 1. Clackamas River Subbasin Vicinity Map.

This feasibility assessment is based in part on recommendations in the U. S. Fish and Wildlife Service's (USFWS) Draft Bull Trout Recovery Plan (draft recovery plan) (USFWS 2002), which calls for such assessments in order to restore, where habitat is deemed sufficient, distribution to previously occupied areas (i.e., historic habitat). Restoring bull trout to historic habitat is a major recovery goal and objective listed in the draft recovery plan and it is particularly relevant to habitats in the western portion of the species' range due to the extensive loss of distribution and the documented extirpation of multiple bull trout populations. The Willamette River, a tributary of the Lower Columbia River, has experienced extirpations of bull trout from three, and perhaps four, major subbasins, including the Clackamas River.

Although the overall recovery strategy is to reduce and minimize threats affecting bull trout and their habitat in the Willamette River Basin, the magnitude of bull trout extirpations, combined with the size of the basin and low probability of natural recolonization, will likely require reintroductions.

Epifanio et al. (2003) outlined four questions that should be addressed before implementing a reintroduction program. The CRBTWG reviewed the four questions and adapted them to provide the focus and structure for this feasibility assessment:

1. Is there a high level of confidence that bull trout are no longer present that would serve as a natural gene bank?
2. Is there suitable habitat remaining, what conditions or stressors have prevented bull trout from occupying suitable habitats, and have these been corrected?
3. Is suitable habitat reasonably expected to be recolonized through natural processes if conditions are improved?
4. Is a suitable or compatible donor population(s) available that can itself tolerate some removal of individuals?

This feasibility assessment addresses the four questions above, as well as other issues the CRBTWG identified as necessary to address in an evaluation of a possible bull trout reintroduction effort in the Clackamas River. An overview of the various sections of the assessment is provided below.

Each chapter in this assessment begins by outlining the key questions pertinent to that chapter and ends with a brief summary providing specific recommendations or conclusions where appropriate.

Chapter 1 reviews the history of bull trout and the reasons for their decline, provides a summary of interagency efforts confirming the absence of bull trout in the Clackamas River Subbasin, and highlights key recommendations from the draft recovery plan (USFWS 2002).

Chapter 2 assesses important habitat considerations, outlining both the presumed historical distribution of bull trout in the Clackamas River and the current suitable habitat.

Chapter 3 provides an analysis of potential donor stocks and addresses genetic considerations.

Chapter 4 addresses potential ecological interactions between bull trout and nonnative brook trout and between bull trout and native fish species, including those listed under the ESA. Chapter 4 also examines food web considerations and the adequacy of a prey base to support a self-sustaining, reintroduced population of bull trout.

Chapter 5 summarizes the preceding chapters, outlines additional considerations should a reintroduction be proposed, and identifies the need for an adaptive management approach.

An earlier draft of this assessment (November 2006) was prepared and distributed for review. At the request of the Oregon Department of Fish and Wildlife (ODFW), an independent scientific review of the earlier draft was completed by the State of Oregon Independent Multidisciplinary Science Team (IMST). The earlier draft was also reviewed by other local bull trout experts. Changes to the earlier draft are incorporated into this final assessment based on feedback from the IMST and other reviewers. A detailed response to each comment made by the IMST is appended at the end of this document.

Geographic Area of Focus

The primary geographic area of focus for this assessment is the Clackamas River and its tributaries upstream of North Fork Dam at river mile (RM) 30 (Figure 1. 2). Approximately 71 percent of the land in this portion of the subbasin is under federal ownership, administered by the U. S. Forest Service (USFS) and the Bureau of Land Management (BLM). Approximately 2. 8 percent is in tribal ownership on the extreme eastern edge of the watershed (Confederated Tribes of the Warm Springs Reservation). No suitable bull trout spawning and rearing habitat is known to occur downstream of the North Fork Dam. The only suitable spawning and rearing habitat for bull trout occurs in the headwaters of the subbasin on lands administered by the USFS.

In the Clackamas River Subbasin within the National Forests boundary (171,051 hectares), there are 165,540 hectares (413,850 acres) of National Forest ownership or 96. 8 percent of the land base, 1,602 hectares (4006 acres) BLM or 1 percent of the land base, and 3,909 hectares (9,772 acres) of private or 2. 2 percent of the land base approximately.

The Upper Clackamas River which consists of the entire watershed upstream of the river's confluence with Collawash River and where all suitable bull trout spawning and rearing habitat is located, encompasses 40,624 hectares (101,560 acres). The majority of this 5th field hydrologic unit code (HUC) watershed is in U. S. Forest Service ownership at 38,105 hectares (95,263 acres) or 93. 8 percent; 2,240 hectares (5,600 acres) or six percent are in tribal ownership (outside of the national forest boundary); and 64. 4 hectares (161 acres) or 0. 2 percent are in private ownership.

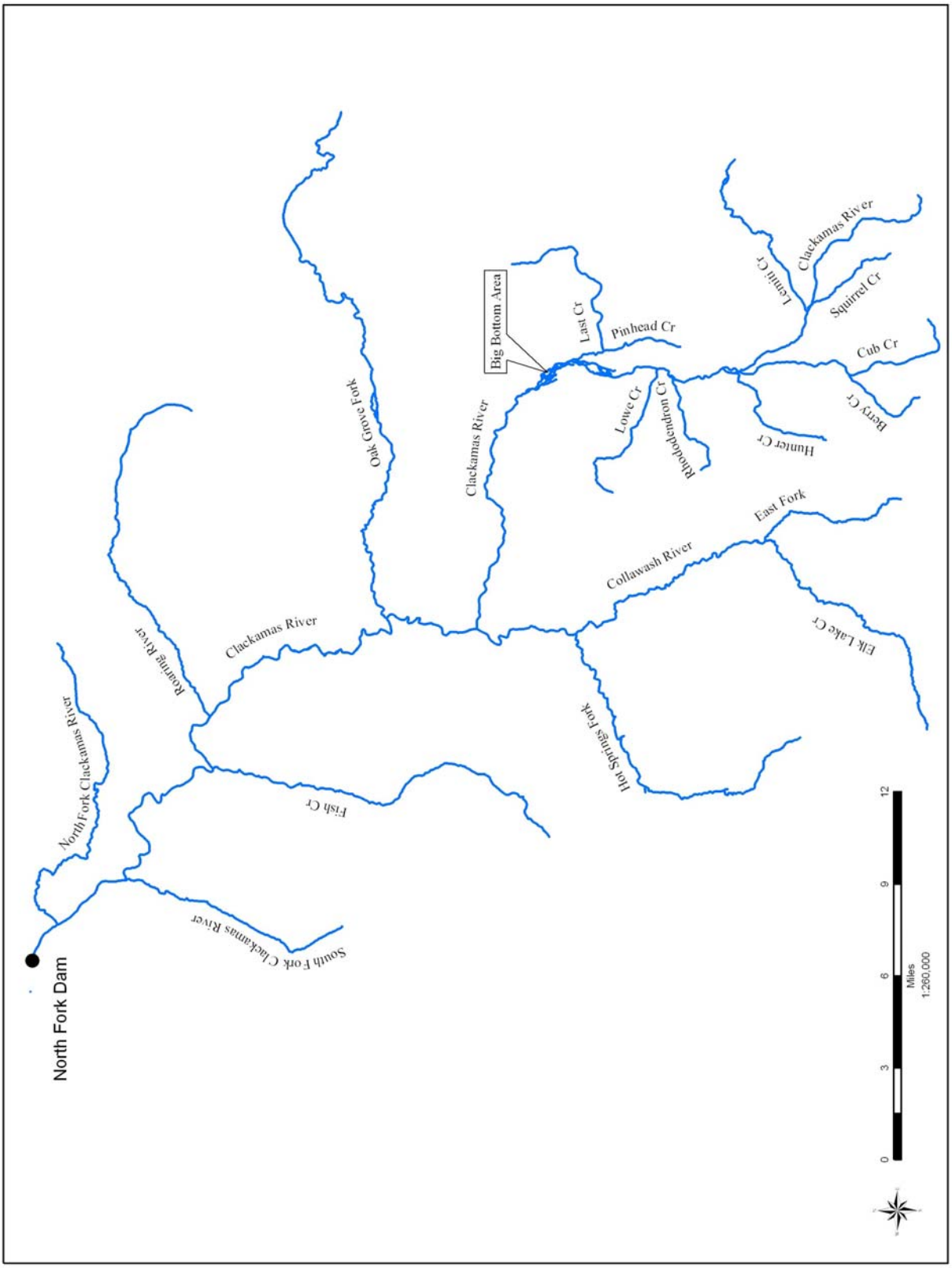

Figure 1. 2. Clackamas River Subbasin Upstream of North Fork Dam.

The Clackamas River Bull Trout Working Group (CRBTWG)

The Clackamas River Bull Trout Working Group (CRBTWG) is comprised of local fish biologists who work in the Clackamas River Subbasin. The CRBTWG originated in the early 1990s with three primary partners: ODFW, Portland General Electric (PGE), and USFS. Beginning in 1999, the federal recovery planning efforts that followed the 1998 listing of bull trout provided the mechanism to expand the collaborative partners in the CRBTWG to include representation from other local, state, federal, and tribal governments. In 2001, efforts were initiated to begin implementing actions outlined in the draft recovery plan, thus reuniting the CRBTWG with additional partner representation. Joining the CRBTWG was Clackamas County, the Confederated Tribes of the Warm Springs (CTWS), and the USFWS.

The key questions to be addressed in Chapter 1 are:

- What is the historical distribution of bull trout in the Clackamas River?
- Are bull trout still present in the Clackamas River?
- What were the causes/factors for their decline?
- Have those causes/factors been corrected?
- What are the key recommendations from the draft recovery plan for the Clackamas River Subbasin?

1.2 Willamette River Basin Overview

The distribution and abundance of bull trout has declined dramatically throughout its range, especially west of the Cascade Mountains in Oregon (Ratliff and Howell 1992, Goetz 1994, Buchanan et al. 1997). Because of the present or threatened destruction, modification or curtailment of its habitat or range, the USFWS listed bull trout in the lower 48 states in 1998 as threatened under the ESA.

With the exception of the McKenzie River, bull trout in the Willamette River Basin of western Oregon have been extirpated from all subbasins where they were found historically. The dates of last verified observations of bull trout from each subbasin are: 1963 from the Clackamas River, 1953 in the South Santiam River, 1945 in the North Santiam River, and 1990 in the Middle Fork Willamette River (Figure 1. 3).

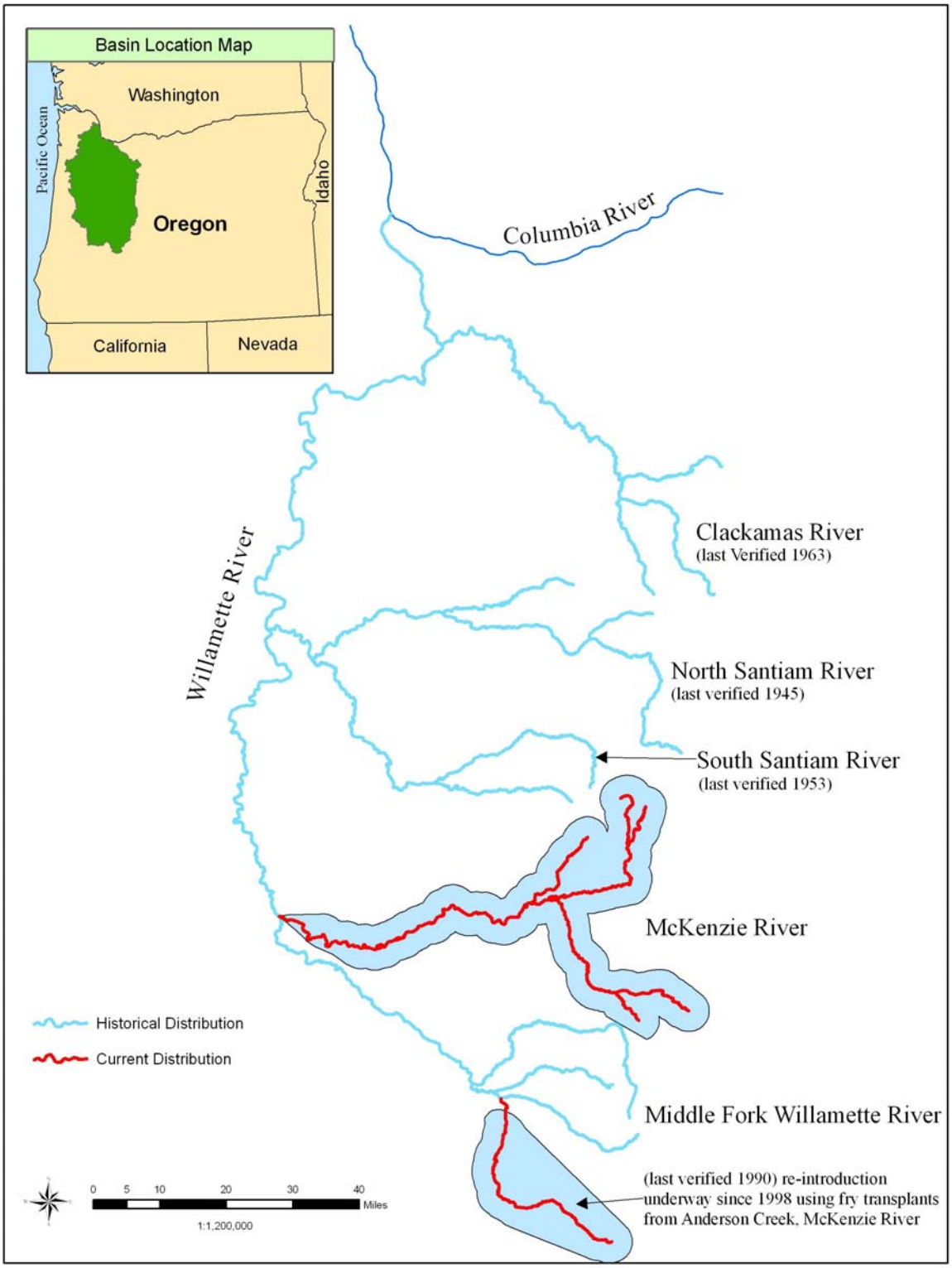

Figure 1. 3. Historic vs. Current Bull Trout Distribution in the Willamette River Basin.

As noted above, the historic population of bull trout in the Middle Fork Willamette is thought to have been extirpated. However, a small number of bull trout currently exist in the upper Middle Fork Willamette River, most likely from an effort to transplant bull trout fry from the McKenzie River to rearing areas above Hills Creek Reservoir. Transplants of fry occurred from 1997 to 2005 and will continue again starting in 2007. Limited bull trout spawning likely representing recruitment of adults from these transplants was documented in the Middle Fork Willamette River in 2005 and 2006.

The McKenzie River currently supports two small isolated populations of bull trout, each numbering less than 100 spawning adults, and one migratory population in the mainstem McKenzie River comprised of approximately 130 spawning adults. The two isolated populations in the McKenzie River resulted from the construction of Trail Bridge Dam in 1963 on the upper mainstem McKenzie River, and Cougar Dam in 1963 on the South Fork McKenzie River. These two dams isolated bull trout above them and fragmented what was historically a single McKenzie River population.

1.3 Clackamas River Subbasin Overview

The last documented bull trout observation in the Clackamas River system was in 1963 (Goetz 1989), although anecdotal evidence suggests they were present in the subbasin through the early to mid-1970s (Zimmerman 1999). Compared to other subbasins of the Willamette River historically occupied by bull trout, a relatively significant amount of information, both verified and anecdotal, is available for the Clackamas River. Most historical records from the Clackamas River refer to bull trout as “Dolly Varden” because bull trout were not widely recognized as a distinct char species until the work of Cavender (1978) and Haas and McPhail (1991). A chronology of available information is detailed below:

Verified Reports and Citations

- The oldest record of bull trout in the Clackamas River Subbasin occurred in 1878 when a specimen collection was made by Livingston Stone. This specimen was located by the CRBTWG in 2005 and currently resides in the Smithsonian Institute, in Washington D. C.
- Murtagh et al. (1992) cited a newspaper article in a 1914 edition of the Estacada Progress that offered a prize for the largest “Dollar-Varden” caught in the Clackamas River.

- Extensive creel surveys of trout anglers were conducted by the Oregon Game Commission (OGC) in 1941 and 1946. In 1941, 28 "Dolly Varden" were caught in a seven-mile reach of the Clackamas River (RM 48 to 55) extending from Indian Henry and the Alder Flat, upstream to one mile above the mouth of the Collawash River (Nielson and Campbell 1941). The study reach included the extreme lower reaches of the Oak Grove Fork Clackamas and Collawash rivers. Total effort during the April 12 to October 15, 1941 trout season was 7,956 angling hours. "Dolly Varden" comprised 0. 3 percent of the total trout catch, and 12 "Dolly Varden" exceeded 14 inches in length. In 1946, the study area along the mainstem Clackamas River was shortened by one mile and the trout season was shortened (May 11- October 10). However, total effort in 1946 (7,734 angling hours) was similar to 1941 (Campbell 1947a). Two "Dolly Varden" were caught in 1946 and comprised 0. 04 percent of the total trout catch. One "Dolly Varden" exceeded 16 inches in length. In addition to bull trout caught within the Clackamas River study area, Campbell (1947b) reported an additional two "Dolly Varden" were caught in 1946 in the Clackamas or Collawash Rivers outside the study area.
- The annual creel census conducted by the OGC included "Dolly Varden" between 12 and 14 inches caught in the Clackamas River in 1960 (Stout 1960).
- One "Dolly Varden" was captured in North Fork Reservoir during a 1963 OGC trap net survey (Stout 1963).
- The OGC reported in 1964, "limited numbers of "Dolly Varden"…are widely scattered in the drainage" (Hutchison and Aney 1964).
- Massey and Keeley (1996) reported two 16 to 18 inch bull trout caught by an angler in 1973 from the mainstem Clackamas River near the mouth of the Oak Grove Fork.

Anecdotal Reports

- Cole Gardiner recalled catching bull trout in the late 1930s in the Clackamas River at Memaloose Bridge and the canyon above Faraday. He said that anglers threw them on the bank (Cole Gardiner, angler, personal communication, September 15, 1997).
- Dick Pugh reported that his father, who worked for PGE, fished in the subbasin since the 1920s. He caught "Dolly Varden" as recently as 1953-1954 in the Collawash River and the Clackamas River near the mouth of the Collawash River. Mr. Pugh did not recall the size of the fish. The fish were typically hung on fence posts. He never heard of bull trout being caught in the Oak Grove Fork (Dick Pugh, angler, personal communication, September 22, 1997).
- Eberl and Kamikawa (1992) referred to anecdotal evidence that bull trout were once "plentiful" in Berry Creek, and probably Cub Creek.
- Massey and Keeley (1996) received an anecdotal report of two 18 to 20 inch bull trout caught by an angler in 1959 from the Collawash River near the mouth of the Hot Springs Fork.

- Gene McMullen reported that as a child (late 1930s and 1940s) he used to catch fish that he suspected were bull trout in the Collawash River and the Big Bottom area of the Clackamas River. The largest was 12 inches, but he recalled seeing larger fish on the bottom of a deep pool on the Collawash River near the mouth of the Hot Springs Fork. Mr. McMullen described the fish as "char-like," although he was uncertain whether the fish were bull trout, brook trout, or brown trout (Gene McMullen, angler, personal communication, September 22, 1997).
- Chet Green reported that his father used to catch "Dollies" in the 1920s in the Clackamas River above Three Lynx. Mr. Green has never caught a bull trout himself in the Clackamas River Subbasin, although he has fished extensively in the Oak Grove Fork and the Collawash River for years (Chet Green, angler, personal communication, September 22, 1997).
- Brian Nordlund reported that he caught a bull trout about 14 inches long in the spring or early summer of 1963, but it could have been "a year or two later. " The fish was caught in the pool beneath the short falls right above the Three Lynx/Oak Grove Powerhouse on the mainstem of the Oak Grove Fork. Mr. Nordlund further stated that his brother caught a second "Dolly" a couple years later in the same pool (Brian Nordlund, angler and fish biologist, personal communication, March 7, 2005).

Based on the size of bull trout recorded in creel records dating from the 1940s and the locations where fish were caught, at least a portion of the bull trout population in the Clackamas River Subbasin is strongly suspected to have had a fluvial life history.

1.4 Historical Distribution of Bull Trout in the Clackamas River Subbasin

The historical distribution of bull trout in the Clackamas River Subbasin is approximated using assembled information on sightings, documented occurrences, and known distribution of extant bull trout populations elsewhere in the Lower Columbia River Basin. A review by ODFW in 1998 of historical records and anecdotal accounts suggests that bull trout distribution once extended from North Fork Reservoir upstream to the Big Bottom area of the mainstem Clackamas River, as well as the lower Collawash River and the lower Oak Grove Fork of the Clackamas River (Zimmerman 1999). No information exists regarding historic abundance or the location of bull trout spawning and rearing areas. The extent to which adult bull trout utilized the lower Clackamas River below the site of the river's first hydroelectric dam (Cazadero Dam) is unknown. Bull trout from the Clackamas River Subbasin conceivably migrated to the upper Willamette River mainstem above Willamette Falls or to Lower Columbia River tributaries (Zimmerman 1999). Figure 1. 4 shows the presumed historical distribution of bull trout in the Clackamas River Subbasin for the time period during the mid- to late-1800s. The CRBTWG assumed that bull trout were not historically present upstream of waterfall barriers known to impede upstream movement of anadromous salmon and steelhead species. This assumption is consistent with bull trout presence in other river systems in the Willamette River Basin and other basins in the Lower Columbia River Basin. The historical distribution of bull trout in the Clackamas River Subbasin as reported in Buchanan et al. (1997) was updated by the CRBTWG based on this primary assumption and additional review of historical records, sightings, and anecdotal information as previously presented.

The CRBTWG used a tiered approach, described below, to approximate the historical distribution of bull trout in the Clackamas River Subbasin.

Tier One – All sections of rivers and streams upstream of waterfall barriers known to impede the upstream movement of anadromous salmon and steelhead species were excluded.

Tier Two – All site locations where there are confirmed sightings of bull trout from specimen collections, documented creel surveys, or fish sampling records by state or federal fish biologists were included. In the upper portion of the subbasin, multiple confirmed sightings within close proximity of one another (within four to five miles) were determined to be sufficient by the CRBTWG to map entire segments of river as confirmed historical bull trout presence. River segments mapped for confirmed historical bull trout presence in Figure 1. 4 include:

- The Clackamas River from approximately RM 43 (upstream of the Roaring River confluence) to approximately RM 58 (roughly two miles upstream from the Collawash River confluence).
- The Oak Grove Fork from its mouth upstream approximately one-half mile.
- The Collawash River from its mouth upstream to the Hot Springs Fork confluence (RM 0 to ~4).

Two additional confirmed historical sightings occur in the lower and middle portions of the subbasin. These include a collection in 1878, along the lower section of the Clackamas River near Clear Creek and another in 1963, in North Fork Reservoir (Stout 1963) along the middle section of the Clackamas River. Since these confirmed historical sightings are of considerable distance from one another and from those in the upper portion of the subbasin, the CRBTWG mapped only a short segment of river as "confirmed presence" just upstream and downstream of these locations.

Tier Three – All segments of rivers and streams for which there are anecdotal records (i.e., angler reports) of historical bull trout sightings were mapped. This third tier takes in a considerable number of river and stream segments in the middle and upper portions of the subbasin. These include:

- The Clackamas River from below the North Fork Clackamas River confluence (RM 30) upstream to the Roaring River confluence (RM 42. 8).
- Roaring River from its mouth upstream to a waterfall barrier at RM 3. 5.
- The Clackamas River from approximately RM 58 (roughly two miles upstream from the Collawash River confluence) upstream to approximately RM 74 at the confluence of Cub Creek.
- Cub and Berry creeks, tributaries to the upper Clackamas River.

<u>Tier Four</u> – All remaining segments of rivers and streams were mapped within the "probable historic distribution" for bull trout. These segments are considered likely to have contained bull trout historically given the wide-ranging nature of bull trout and more favorable habitat conditions assumed to exist in the mid- to late-1800s.

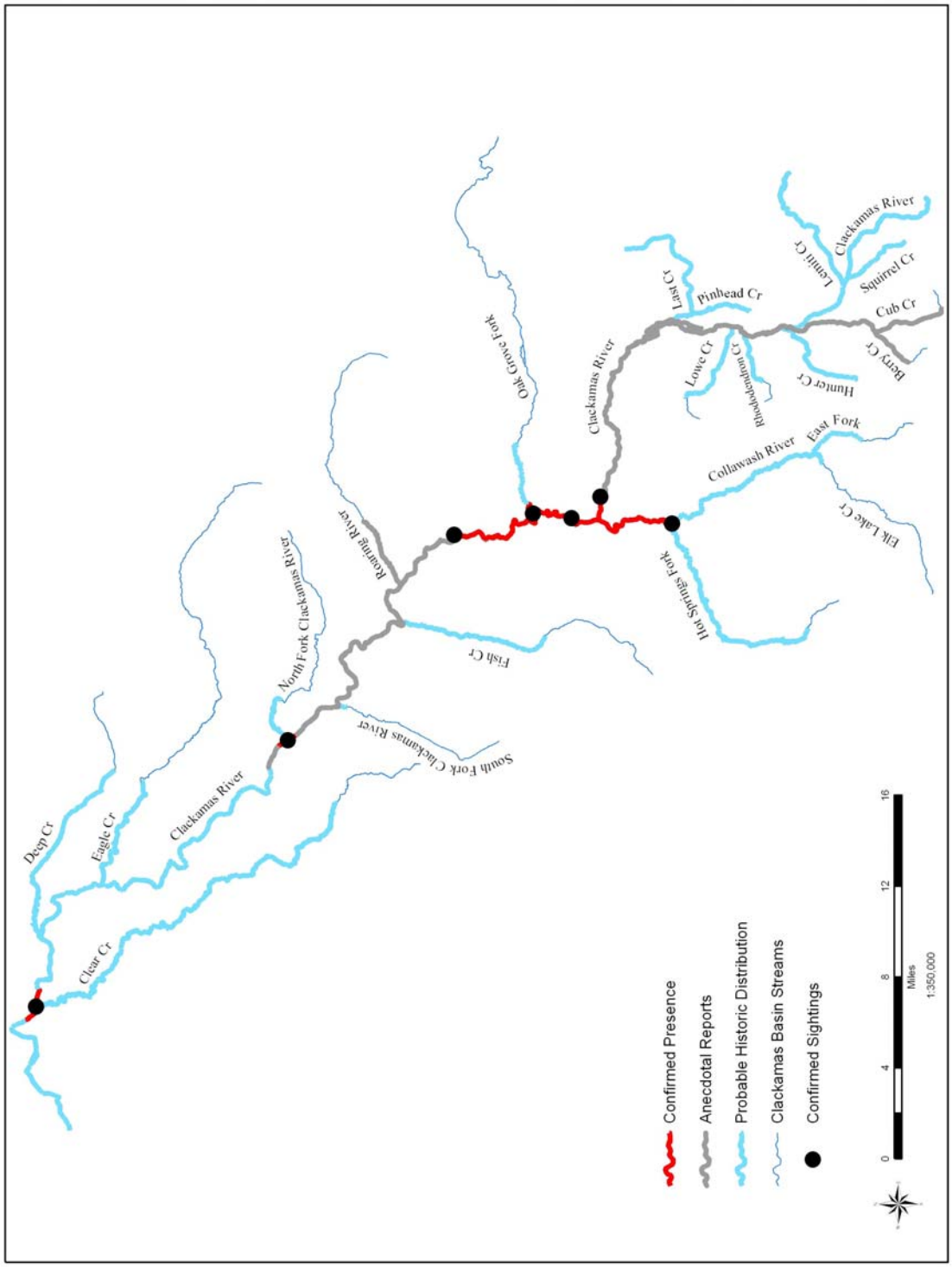

Figure 1. 4. Historical Distribution of Bull Trout in the Clackamas River Subbasin.

1.5 Overview of Bull Trout Surveys in the Clackamas River Subbasin

One of the earliest documented collections of bull trout (or "Dolly Varden" as they were known then) in the Columbia River Basin came from Livingston Stone in the lower Clackamas River in 1878 (Smithsonian Institution 2005). Yet, despite the elapsed time from that early collection, little else was known about bull trout in the Clackamas River, other than they were present in the watershed in the 19th Century and much of the 20th. Until the 1980s or later, when focused bull trout studies first began, this scarcity of information was common for most river systems containing these native char (Dodson and Brun 2003).

In the Clackamas River Subbasin, increasing interest in the status of Clackamas River bull trout began shortly after 1989 when the American Fisheries Society listed the bull trout as a species "of special concern" (Williams et al. 1989, cited in Buchanan et al. 1997). Bull trout had only been accepted as a species separate from Dolly Varden in 1980 by the American Fisheries Society, after Cavender (1978) described their taxonomic status. In October 1992, bull trout were petitioned to be listed under the federal ESA by several Montana conservation organizations. These rapid developments spurred biologists from ODFW, PGE, and the USFS to begin surveying portions of the Clackamas River Subbasin thought most likely to contain a remnant bull trout population (Eberl and Kamikawa 1992, Zimmerman 1999).

Initial surveys in a number of streams occurred in 1990, 1991, and 1992, but no bull trout were found. More extensive surveys occurred in 1992, 1998, 1999, and again in 2004, but all failed to document the presence of bull trout in the subbasin. The presence/absence surveys that occurred during this timeframe (1990 – 2004) varied in geographic scope, survey effort, and survey methodology. These survey efforts are summarized below:

Early 1990s Survey Efforts (1990 – 1992)

ODFW and the Estacada Ranger District of the USFS received occasional, unverified reports of bull trout caught in the upper tributaries of the Clackamas River Subbasin up to the early 1990s. These reports, combined with suitable bull trout habitat identified by local fish biologists, suggested the need for surveys to find any relict local populations. Fish biologists from ODFW and USFS conducted numerous surveys throughout 1990-1992. A brief summary of these surveys, as reported in Eberl and Kamikawa (1992) is provided below:

1990 Surveys

- Cub Creek (upper Clackamas River tributary): Electrofished by ODFW in mid-July. Cutthroat trout were captured.
- Last Creek (tributary to Pinhead Creek): Electrofished by USFS in the summer. Cutthroat trout of various life stages were captured. This stream was electrofished again by ODFW in 1992.
- Pinhead Creek (tributary to the upper Clackamas River): Electrofished by ODFW in mid-July. It was electrofished again in late-September. All captures were rainbow or cutthroat trout, young coho salmon, or sculpin. Adult spring Chinook were spawning above the area of survey.

- Berry Creek (tributary of Cub Creek): Electrofished in mid-July by ODFW. Cutthroat trout of different life stages were captured.
- Shellrock Creek (tributary to the Oak Grove Fork): Electrofished in late-July by ODFW. Cutthroat trout were present.
- Chief Creek (tributary to Shellrock Creek): Electrofished by ODFW in late-July. Various life stages of cutthroat trout were identified.
- Hunter Creek (tributary to the upper Clackamas River): Electrofished by ODFW in mid-July. Sculpin and various life stages of cutthroat trout were recorded.
- Lowe Creek (tributary to the upper Clackamas River): Sampled using unknown methods (assumed to be electroshocking) in mid-July by ODFW. Various age classes of cutthroat trout were sampled.
- Rhododendron Creek (tributary to the upper Clackamas River): Electrofished by ODFW in mid-July. Various life stages of cutthroat were found.
- Squirrel Creek (tributary of the upper Clackamas River): Electrofished by ODFW in mid-July. Various life stages of cutthroat trout were captured.

1991 Surveys

- Stone Creek (tributary to the Oak Grove Fork): Electrofished by USFS in August. Surveyors found moderate numbers of cutthroat trout.
- Collawash River (tributary to Clackamas River): Day-time snorkel survey by USFS in late-September targeting potential adult bull trout spawners. Native rainbow trout and Chinook salmon were observed.
- Elk Lake Creek (tributary to Collawash River): Electrofished in mid-September by USFS; also day-time snorkel survey in late-September by USFS to target potential adult bull trout spawners. Cutthroat trout and rainbow trout were encountered.
- Upper Clackamas River: day-time snorkel survey in September by USFS targeting potential adult bull trout spawners. Brook trout were observed spawning in this area.

1992 Surveys

In 1992, a more in-depth sampling of selected streams for bull trout was incorporated into a cooperative Challenge Cost Share project between the USFS and ODFW. The 1990-1991 survey efforts summarized above were widely spread throughout the Clackamas River Subbasin with limited effort devoted to any one stream. Eberl and Kamikawa (1992) selected four streams thought to have characteristics potentially suitable to support bull trout: Farm, Berry, Pinhead, and Dickey creeks. These four streams were selected for more intensive surveys because they were higher elevation and/or cold, spring-fed streams that also contain high levels of cover. All four streams were surveyed below natural waterfall barriers that limit upstream access for anadromous fish species (i.e., salmon and steelhead).

Hankin and Reeves Level III surveys were utilized to identify where stream habitat units having complex physical characteristics of abundant woody material, substrate cover, and/or undercut banks might be located. Stream units identified with the above physical complexity that appeared most suitable for bull trout were subsequently sampled via electroshocking. One stream, Pinhead Creek, was not surveyed with a Level III survey since it had an abundance of complex habitat and woody material in many of the habitat units and would have consumed prohibitive amounts of survey time. Dickey Creek was only partially electrofished because of low stream conductivity, high fish mortality during sampling, and limits on time available. Berry, Farm, and Pinhead creeks were electrofished as originally planned. Night snorkeling to locate bull trout was contemplated but deferred when no evidence of bull trout was discovered during electrofishing efforts.

In addition to the focused efforts on the above four streams, survey crews daytime snorkeled three major rivers during the late summer to target potential adult bull trout spawners. The three rivers included the upper Clackamas River (four miles), Collawash River (four miles), and East Fork Collawash River (two and one-half miles). No bull trout were observed (Eberl and Kamikawa 1992).

Late 1990s Survey Efforts (1995 and 1998 – 1999)

In 1995, a bull trout snorkel survey effort was implemented on approximately 10 miles of the mainstem Clackamas River near its headwaters (Zimmerman 1999). No bull trout were reported.

Additional bull trout presence/absence surveys were conducted in 1998 and 1999, but they failed to find any bull trout in the upper portion of the subbasin. Mark Zimmerman (1999) of ODFW led the survey effort. Prior to initiating surveys, he reviewed all of the available historic information known to exist for bull trout in the Clackamas River. His effort compiled historic agency survey records and anecdotal reports of bull trout in the subbasin. Field surveys were then completed over two years, with informal walking surveys implemented on ten streams in September and October of 1998. Survey crews recorded qualitative physical habitat characteristics of stream reaches walked. Water temperature and connectivity data was collected at the lower and upper limits of reaches surveyed. As streams were walked, surveyors also utilized hook and line sampling with artificial lures. Captured fish were identified and measured before release.

From Eberl and Kamikawa (1992), a total of five streams were selected to be snorkel surveyed in 1999. Daytime snorkeling on Berry, Cub, Farm, Dickey, and Elk Lake creeks was decided as the most effective method, especially for the possibility of observing bull trout fry. Resident salmonids and one sculpin were recorded in the 1999 snorkel surveys. Hook-and-line sampled streams documented cutthroat trout in the upper Clackamas and Oak Grove Fork watersheds, while only rainbow trout were captured in the streams sampled in the Collawash River Watershed. No bull trout were captured or observed in any of the 1998-1999 surveys (Zimmerman 1999).

2004 Survey Effort

As part of this feasibility assessment, the CRBTWG discussed the need for a definitive, statistically valid study to determine if bull trout were still present in suitable habitat remaining in the Clackamas River Subbasin. Previous presence/absence surveys, although numerous and widespread, were statistically weak. In order to address the first question raised by Epifanio et al. (2003); *"Is there a high level of confidence that bull trout are no longer present that would serve as a natural gene bank?"*; the CRBTWG in 2004 conducted a final presence/absence survey for bull trout in the Clackamas River Subbasin using the survey protocol developed by Peterson et al. (2002) for the Western Division of the American Fisheries Society (WDAFS). As described by Strobel (2005):

> *This protocol estimates sampling efficiencies for different methods and combine(s) that information with data on the distribution of bull trout densities to estimate detectability of small bull trout (less than 150 mm total length). Single sample estimates of detectabililty can be combined to estimate the number of samples required to estimate an acceptably low probability of presence, provided that bull trout are not detected. Technically, failure to detect bull trout should be interpreted to mean that bull trout are unlikely to occur with the distribution of densities assumed in the WDAFS protocol.*

A sampling frame or area of habitat was selected for detecting the probability of bull trout presence. Sampling units were made up of individual stream segments nested within the sampling frame. These sampling units were completely surveyed. Since water temperature is a known major determinant for bull trout presence (Dunham and Chandler 2001; Dunham et al. 2003), a review of all temperature sets for tributaries in the Clackamas River Subbasin upstream of North Fork Dam were reviewed. Streams with maximum temperatures exceeding 15 degrees Celsius were not included in the sampling frame. The upper Clackamas River above its confluence with the Collawash River remained the only watershed with suitable amounts of cold water stream habitat that fit the desired sampling frame. Additionally, streams found in this portion of the subbasin that are less than two meters (~seven feet) in summer wetted width or are too large to night snorkel safely were not selected for sampling units. The Peterson et al. (2002) protocol calls for sampling units to be bounded by block-nets during snorkel surveys. Since this requirement was difficult to implement in remote, sometimes hazardous terrain, during darkness, an alternative was developed by Jason Dunham, a coauthor of the protocol. In lieu of the protocol's 50-meter sampling units enclosed by block nets, sampling units were enlarged to 200 meters in length without enclosure by block nets to reach equivalent detection probabilities. Using the adjusted protocol, a total of 40 sampling units were randomly selected.

Surveys were implemented via single-pass night snorkeling that began on August 18 and were completed on October 1, 2004. Upper and lower limits of sampling units were flagged or marked. Each unit was sampled by two or three experienced snorkelers from the USFS, USFWS, or SWCA Environmental Consultants, who were funded by PGE. The survey protocol called for all brook trout and bull trout to be counted and estimates of lengths recorded. Rainbow and cutthroat trout less than 200 mm total length were estimated in each unit by qualitative rankings of absent, few, or abundant. These were ranking determinations made by the snorkel surveyors completing each sampling unit. Other aquatic species were recorded when found and habitat information of interest, such as instream woody material and overall habitat quality, was also recorded.

An extension of the WDAFS protocol also allows for the use of earlier collected data and professional experience, expertise and other forms of prior knowledge to contribute to assessments of continued bull trout presence (Peterson and Dunham 2003). Strobel (2005) described its use:

> *In a system where considerable experience and survey effort have rendered the possibility of an undetected bull trout population unlikely, and a conservative level of probability can be assigned to the presence of bull trout, this level of probability can be combined with those derived from individual sampling units to increase power. Nine local fish biologists with independent knowledge and experience in the upper Clackamas watershed were individually surveyed to obtain estimates of the probability of bull trout being present in the basin, based on professional judgment. Estimates of probability were made without consideration of the results of the bull trout surveys conducted in the summer of 2004. The results from this survey of local expertise were then summarized and used to establish a conservative estimate of the probability that bull trout exist in the upper Clackamas River watershed, based on experience and survey efforts prior to the 2004 surveys.*

The 2004 snorkel surveys failed to detect bull trout in any of the sampled units. Surveys were completed for 21 sampling units, equaling 4. 2 kilometers (2. 5 miles) of stream or 9. 3 percent of the sampling area or frame. The 2004 surveys had an overall power to detect the presence of bull trout in the upper portion of the subbasin sampled of 88 percent. The Peterson and Dunham (2003) protocol allows prior surveys, knowledge, and local information by professional fish biologists to be incorporated into the overall calculation for power of detection. Strobel (2005) surveyed a number of professional fish biologists with local survey experience in the subbasin and determined their collective estimates of the probability of bull trout surviving in the subbasin ranged from 0. 01 to 5. 0 percent. Considering these estimates by local biologists, Strobel (2005) used a much more conservative estimate of 10 percent that bull trout might still occur within the subbasin. The overall power to detect the presence of bull trout increases to 99 percent using Strobel's conservative estimate of prior knowledge. There remains an extremely low probability that juvenile bull trout may be present in the upper portion of the subbasin sampled at densities below the range observed for other populations.

Additional Fish Surveys and Fish Enumerations in the Clackamas River Subbasin

While the survey efforts summarized above were directed at locating remnant bull trout, many other fish surveys, inventories, and enumerations have also been conducted in several rivers and streams within the subbasin over the past several decades. Although too long to specifically list all of these efforts here, some include: upper limits of fish distribution electrofishing surveys, steelhead and Chinook spawning surveys, monitoring and evaluation snorkel surveys of habitat restoration and improvement projects, pre- and post-hydroelectric development snorkel surveys, fish trapping and photo counting at hydroelectric passage facilities, and a long-term system of cooperatively funded smolt traps that have been operated in the upper subbasin. No bull trout have been detected in any of these other survey or inventory efforts.

Given the cumulative results from past survey efforts and the most recent 2004 statistically oriented, probabilistic sampling effort, CRBTWG members are confident that bull trout have been extirpated in the Clackamas River Subbasin.

1.6 Causes for Decline of Bull Trout in the Clackamas River Subbasin

A broad overview of the causes of decline and extirpation of bull trout in the Western United States is presented in Appendix A. A hypothesis for the local extirpation of bull trout from the Clackamas River Subbasin is provided in Appendix B. The following section provides a summary of the primary factors believed responsible for the decline and extirpation of bull trout in the subbasin.

Dams and Diversions

As early as 1890, the State Fish Commission reported a diversion dam across the Clackamas River near Gladstone that impeded salmon passage. Initially, the dam was a partial barrier to salmon migration. In 1891, the height of the dam was increased and it became a full passage barrier to salmon. H. D. McGuire, the Oregon Fish and Game Protector, filed a complaint against the mill owner (Taylor 1999) and a ladder was installed in 1895 correcting the problem (Wallis 1960). Diversion dams for a variety of purposes existed on many tributaries to the lower Clackamas River from the late 1840s and into the early 1900s. Most of these diversion dams were built without fish passage provisions (Cramer and Associates 2001).

Hydroelectric dams on the mainstem Clackamas River historically presented migration challenges to bull trout. Cazadero Dam (known today as Faraday Dam) was built on the Clackamas River in 1904. The original fish ladder providing access over Cazadero Dam washed out in 1917 and was not rebuilt until 1939. Anadromous fish species, bull trout, and other fish species were blocked from migratory corridors and passage into the upper portions of the subbasin during this 22-year timeframe. River Mill Dam was built soon after Cazadero Dam in 1912, and is located just a few miles downriver. This is the first dam that fish encounter as they migrate upstream from the lower Clackamas and Willamette rivers. The original ladder for River Mill Dam, built in 1912, was modified in 1972 when the entrance was enlarged, attraction flows increased, and an adult fish trap installed. This steep and winding ladder had been thought to impede passage of spring Chinook salmon (Murtagh et al. 1992). The present-day Faraday Dam has a 2. 74-kilometer-long (1. 7 miles) ladder (North Fork fishway) that provides passage past both the Faraday and North Fork dams. North Fork Dam is the third, most upstream hydroelectric dam on the mainstem Clackamas River that was built in 1958. For downstream migrating fish, North Fork Dam has a collection facility that routes them into a pipeline, bypassing all three mainstem dams and exiting below River Mill Dam. Downstream migrants may also leave North Fork Reservoir via the spillway during high flows or through the turbines. These fish must then pass downstream through the Faraday and River Mill projects which are not equipped with juvenile bypass facilities.

Fisheries Management

Historical fisheries management activities were likely a major factor in ultimately extirpating bull trout from the Clackamas River Subbasin. Given its close proximity to the Portland metropolitan area, the Clackamas River historically had and continues to receive heavy angling pressure. Prior to the 1940s, early fisheries management actions focused largely on three areas:

1. trapping salmon and steelhead to supply eggs for early hatchery operations;

2. designation of early sport harvest limits and enforcement; and

3. stocking of high mountain lakes with fingerling trout (in many instances introducing nonnative brook trout).

Prior to 1940, the native trout population in the river system was abundant and sport catch of bull trout was not unusual. Jiggs Pederson, an early USFS employee who worked on trails and roads in the 1920s and 1930s, recalls anglers fishing for trout and bull trout using everything from red huckleberries to live mice floated on small pieces of wood (Pederson 2003). Access to much of the upper subbasin was limited to a few gravel roads or more commonly, foot trails which limited overall trout harvest. Gene McMullen, who fished the upper waters on the Collawash and Clackamas rivers in the late 1940s and early 1950s, recalled with some regret he and two fellow anglers coming out of the roadless country with weekly limits amounting to 100 trout. This was probably commonplace for the time and era. Gene's understanding was, "that after the road penetrated this country, the fishing steadily declined" (McMullen 1994).

With the advance of the road system into the upper subbasin, the native trout populations quickly became over-fished, and fisheries managers turned to trout stocking as a means to meet the demand of increased angling pressure. Fisheries managers also recognized that stocking of fingerling trout would not provide a good return to anglers. Based on investigations completed in the Clackamas River (Lockwood 1948), the 1947 annual report of the Oregon Fisheries Division recommended stocking catchable-sized rainbow trout. Beginning in the 1950s, large numbers of hatchery rainbow trout were being stocked along the roads paralleling the Clackamas and Collawash rivers. By the 1970s, Whitt (1978) reported that over 100,000 hatchery catchable trout were being stocked annually in the Clackamas River and its tributaries. Throughout the 1980s and into 1990s, annual stocking of catchable rainbow trout in the Clackamas River expanded almost two-fold to near 190,000 per year (Murtagh et al. 1992). The Clackamas River became one of the largest trout fisheries in the State of Oregon, with more than a quarter million angler days annually. The large, hatchery supported fishery also negatively affected native steelhead production. A 1988 creel survey revealed that nearly 10,000 hatchery and 800 wild steelhead smolts were harvested in the fishery along with 1,000 coho smolts (Murtagh et al. 1992). In 1968, nonnative summer steelhead was introduced from Skamania and Foster stocks to create a new fishery. Summer steelhead was particularly popular with anglers because they have a long period of freshwater residency and are readily caught. The summer steelhead fishery was primarily in the Clackamas River above North Fork Dam, the same areas where bull trout were last reported. By 1979, summer steelhead harvests were averaging over 5,000 fish per year in the Clackamas River (Murtagh et al. 1992).

In the 1950s and 1960s, during the period of rapid growth in the trout fishery within the Clackamas River, a strong negative attitude was developed towards bull trout. Anglers and fisheries managers considered bull trout to be a voracious predator on juvenile salmon and steelhead, and they quickly gained a reputation as a “trash” fish. Anglers were encouraged to kill bull trout if caught. Fisheries managers even organized fishing derbies and provided bounties to eradicate bull trout from the Clackamas River.

Bull trout were also likely impacted by early commercial fisheries. Bull trout may have been intercepted as a by-catch in commercial fishery nets and traps set in the lower Clackamas and Columbia rivers. As stated earlier, there is evidence that the historic population of bull trout in the Clackamas River exhibited a fluvial life history and may have even contained an anadromous life history component. Bull trout were found historically in the same vicinity as areas of intense commercial fishing operations on the lower Clackamas and Columbia rivers. For instance, Livingston Stone established the first operating fish hatchery in the Columbia Basin in 1877, at the confluence of Clear Creek and the Clackamas River (Cramer & Associates 2001). It is believed that near this location he secured the Clackamas River “Dolly Varden” specimen during the winter of 1877-1878 that is kept at the National Museum (Smithsonian Institution 2005). Overfishing by commercial fisheries in the vicinity presented a problem for the hatchery in securing enough adult Chinook for spawning (Mattson 1950).

In 1876, a commercial harvesting fish trap near the mouth of the Clackamas River nearly closed off the entire river to upstream migrating salmon (U. S. Commission of Fish and Fisheries 1877, cited in Taylor 1999). In 1877, more than 1,000 drift nets, many reaching 1,200 feet in length, were also being set on the Columbia River (Taylor 1999). In 1893, approximately 12,000 adult spring Chinook were harvested by gillnetters in the lower Clackamas River (Smith 1974). By 1908, salmon abundance had declined to the degree that only five or six commercial fisherman still operated on the Clackamas River. In 1910, commercial fishing seasons were designated for the Clackamas River (Taylor 1999).

In the Columbia River estuary, an area often exploited by the historic commercial fisheries, a recent USFWS review of old State of Oregon seining records at the head of the Columbia River estuary, indicated bull trout were caught in seines while apparently foraging in that location (Yoshinaka 2002). Historically, the Clackamas River bull trout population may have utilized the Columbia River estuary for rearing.

Forest Management

Timber was the most important industry in Clackamas County from the late 1950s through the early 1990s (Bryson and Levine 1987). More than three-quarters of the lands in the Clackamas River Subbasin are forested. The USFS (Mt. Hood National Forest) manages over 70 percent of the lands in the subbasin, most of that occurring in the upper subbasin above North Fork Dam. The BLM also manages a small amount of public forestland. Much of the private and county timberlands are scattered in the lower elevation areas of the subbasin.

Aquatic habitat throughout much of the subbasin has been degraded by past clear-cut, timber harvesting and removal of trees in the riparian zone, removal of large wood from stream channels, and road building (Murtagh et al. 1992). Increased sediment loading throughout much of the lower subbasin has decreased stream habitat quality, as well as increased stream temperatures and altered stream channel stability. Road building and regeneration harvesting of forest stands affects hydrologic function and increases peak flows. In some areas of the subbasin the road network is extensive, resulting in high road densities. Prior to the Northwest Forest Plan (USDA and USDI 1994), many riparian corridors were harvested of old-growth timber, and salvage logging conducted after the 1964 flood event further reduced large wood available to streams. It will take decades before these impacted riparian areas will produce mature and old-growth conifers that will once again provide full streamside shading and contribute to large wood recruitment in streams (Horning 1999). Many streams were “cleaned” of large wood in mistaken attempts to improve fish passage during the 1960s and 1970s. The loss of complex, in-stream habitat has had a negative effect on fish habitat productivity.

Agricultural Practices

Bryson and Levine (1987) reported agriculture as second in economic importance to timber production in Clackamas County. Agricultural lands occur at lower elevations primarily in the lower portion of the subbasin and make up approximately one-eighth of the total landbase. Primary crops include berries, fruit, field crops, trees (both Christmas tree farming and nurseries), and livestock. Agricultural activities commonly result in the direct loss of streamside vegetation and an increase in withdrawal of water for irrigation (Murtagh et al. 1992). Likely impacts to aquatic habitat include loss of streamside shade hence increased water temperature, loss of large wood recruitment hence a decrease in habitat complexity, increased bank erosion and sedimentation, and loss of habitat through lack of instream flows.

Residential Development and Urbanization

The majority of residential, commercial, and municipal development has taken place in the lower portion of the subbasin. Major cities within the subbasin include Gladstone and Oregon City near the confluence of the Clackamas and Willamette rivers, Happy Valley, Damascus, Boring, Sandy, Estacada, and Colton. While less than 10 percent of the land base is classified as residential or commercial, recent growth and urban expansion in the last two decades has resulted in a large footprint on the lower mainstem and tributaries. Aquatic habitat-related impacts likely include an increase in impervious surfaces hence altered streamflow regimes and more rapid runoff, loss of riparian vegetation, conversion of forested uplands and loss of wetlands, stream channelization, and reduced water quality through increases in use and run-off of pollutants and pesticides.

1.7 Curtailment of the Causes for Decline of Bull Trout in the Clackamas River Subbasin

It has been over four decades since the last verified and documented capture of a bull trout in the Clackamas River (Zimmerman 1999). While angler reports of bull trout catch followed for approximately a decade after the last verified report, abundance was likely so low that the population was no longer viable. By this time, the population likely entered an unrecoverable population trajectory where extinction was inevitable. Any small impact, individual or cumulative, was likely to send the population into an extinction vortex (Gilpin and Soulé 1986). At about this time, sport angling for catchable rainbow trout and summer steelhead in the upper portion of the subbasin above North Fork Dam was just beginning to boom. Since bull trout are known to be extremely voracious and susceptible to anglers, it is conceivable that heavy sport angling pressure is what finally claimed this population (Post et al. 2003).

Investigating the curtailment of the causes for decline and extirpation of bull trout in the Clackamas River is necessary to evaluate the essential factors which would most influence the success of a reintroduction effort. The CRBTWG has identified primary factors essential to successful reintroduction efforts as fisheries management (particularly sport fishing upstream of North Fork Dam), forest management (i.e., aquatic habitat protection), and hydroelectric dams (passage and screening). Curtailment of other factors (i.e., agricultural practices, residential development and urbanization) that likely contributed to the extirpation of bull trout in the Clackamas River are addressed below; however, the curtailment of these other factors are believed to be secondary in ensuring the success of a reintroduction effort.

Dams and Diversions

Historic diversion dams present in the late 1800s and early 1900s no longer exist in the lower Clackamas River Subbasin on river or stream segments that would impede bull trout migration.

Beginning in the late 1990s, PGE began federal relicensing proceedings for its hydroelectric dams in the Clackamas River Subbasin. In their final license application to the Federal Energy Regulatory Commission (FERC) and in an accompanying Settlement Agreement amongst more than 30 local, state, federal, and tribal governments, non-governmental organizations, and other interested stakeholders, PGE proposed to make several upstream and downstream fish passage improvements for the three dams along the mainstem Clackamas River. One improvement, already completed, was the reconstruction of the River Mill Dam fish ladder. Other improvements include upgrades to the downstream fish collection facility and bypass at North Fork Dam, construction of a new fish trap and handling facility at the North Fork fishway, and new downstream fish passage facilities at River Mill Dam.

The USFWS has not finalized passage and screening criteria specific to bull trout. In the interim, the criteria developed by the National Marine Fisheries Service (NMFS) for anadromous salmonids have guided fish passage facility improvements for the Clackamas River mainstem hydroelectric dams, and it is believed they should be effective for bull trout.

Fisheries Management

With the ESA listings of salmon and steelhead in the late 1990s, fisheries management practices (i.e., sport fishing regulations and stocking of catchable rainbow trout) for the portion of the subbasin upstream of North Fork Reservoir changed substantially. Stocking of catchable rainbow trout within the Clackamas River became restricted to reservoirs (i.e., North Fork Reservoir, Lake Harriet, and Timothy Lake) and was discontinued altogether along the mainstem and tributaries upstream of North Fork Reservoir. As such, sport fishing regulations changed substantially. Bag limits became restricted to adipose fin-clipped trout only, effectively turning all of the river and tributary sections upstream of North Fork Reservoir into a catch-and-release fishery on native trout. Additionally, angling is restricted to the use of artificial flies and lures only. No bag limit or size restrictions are imposed for brook trout. The changes in sport fishing regulations also curtailed angling for salmon or steelhead upstream of North Fork Dam, as this area is considered a wild fish sanctuary and no hatchery salmon or steelhead are allowed upstream of North Fork Dam. Sport fishing in the lower subbasin downstream of North Fork Dam is focused on hatchery salmon and steelhead. All waters in the Willamette Zone for the State of Oregon's sport fishing regulations are closed to angling for bull trout. Commercial fisheries have not operated in the Clackamas River Subbasin since the early 1900s. Commercial fisheries in the Columbia River mainstem and estuary are limited to tribal fisheries and limited gillnet fisheries for Chinook and coho salmon.

Beginning in 2003, the ODFW and USFS began collaborating on stocking of high mountain lakes in the upper portion of the subbasin. ODFW no longer stocks brook trout in lakes with outlets to rivers and streams that provide suitable bull trout spawning and rearing habitat.

With the significant changes in angling regulations, primarily in the upper subbasin above North Fork Dam, the CRBTWG believes this factor for decline has been addressed. Additional changes to angling regulations in the upper portion of the subbasin are believed unnecessary to support a successful reintroduction of bull trout.

Forest Management

The majority of lands in the upper portion of the subbasin are public forestlands administered by the USFS and BLM. These lands are managed in accordance with Mt. Hood National Forest Land and Resource Management Plan (USFS 1990) and Salem District BLM Resource Management Plan (USDI 1995), respectively, as amended by the 1994 Northwest Forest Plan (USDA and USDI 1994). The 1994 Northwest Forest Plan established an Aquatic Conservation Strategy (ACS) with protective measures, standards and guidelines, and land allocations to maintain and restore at-risk fish species of which bull trout were included. The ACS Riparian Reserve land allocation extends two full site potential tree heights (300 feet minimum) on both sides of all fish-bearing streams and prohibits scheduled timber harvest. These plans provide substantial protections for watersheds and aquatic habitats on public lands in the upper subbasin administered by the USFS and BLM.

Forest management activities on non-federal lands are regulated by the State of Oregon Forest Practices Rules. County, state, and private timberlands managed in accordance with these rules occur primarily in the lower portion of the subbasin most likely outside of historical bull trout spawning and rearing habitat. However, streams within the lower portion of the subbasin (i.e., Rock, Clear, Richardson, Deep, and Eagle creeks) may have provided important rearing, overwintering and foraging habitat for bull trout historically. These streams, while currently impacted to some degree by urbanization, may still provide overwintering and foraging habitat for bull trout if a reintroduced population in the upper subbasin were to expand into the lower Clackamas River Subbasin and the Willamette River. No additional changes or protections regarding forest management activities on public or non-public forest lands are believed necessary to support a successful reintroduction of bull trout in the Clackamas River Subbasin.

Agricultural Practices

Similar to non-federal timberlands, agricultural lands occur primarily in the lower portion of the subbasin, most likely outside historical bull trout spawning and rearing areas. Although degraded to a degree from agricultural practices, streams within the lower portion of the subbasin could provide important migratory habitat for sub-adult or adult bull trout. No additional changes or protections regarding agriculture practices are believed necessary to support a successful reintroduction of bull trout in the Clackamas River Subbasin.

Residential Development and Urbanization

Residential development and urban growth is likely to continue to expand in the lower portion of the subbasin. Areas where expansion is expected to continue are located in sub-watersheds to tributaries in the lower portion of the subbasin, similar to where non-federal timberlands and agricultural lands are located. The difference here is that anticipated residential, commercial, and industrial expansions will likely be tied much more closely to urban centers which are predominantly in the lower portions of tributary streams in the lower subbasin outside of likely historical spawning and rearing habitat for bull trout.

1.8 Key Recommendations from the Willamette Chapter of the Draft Bull Trout Recovery Plan

Bull trout were listed as threatened in the Columbia and Klamath River Distinct Population Segments (DPS) on June 10, 1998 (50 CFR 17, Vol. 63(111):31647-31673). Concurrently, a proposed rule was published to list all remaining bull trout within three additional DPS's in the contiguous U. S. (Coastal/Puget Sound, Jarbidge River, and St. Mary/Belly Rivers). In November, 1999, a final rule determined threatened status for "all populations of bull trout within the United States," thus making the original listing coterminous (50 CFR 17, Vol. 64(210):58910-58936), meaning the five DPSs were consolidated into one listed taxon. Furthermore this rule stated that: "for the purposes of consultation and recovery, we (USFWS) recognize these five DPSs (Columbia River, Klamath River, Coastal-Puget Sound, Jarbridge River, and St Mary-Belly River) as interim recovery units" because of their uniqueness and significance.

At the time of publication of the draft bull trout recovery plan (October 2002), the Willamette Basin was identified as a "recovery unit," one of 27 recovery units described within the coterminous listing. Almost immediately upon publication, the USFWS recognized that these units may not meet the USFWS standard for "recovery units" and decided to call them "management units. " Consequently, "recovery units" as described in the draft bull trout recovery plan are interchangeable with "management units".

The Willamette River Bull Trout Recovery Unit Team (Recovery Unit Team) identified the Upper Willamette River as a "core area" (i.e., the closest approximation of a biologically functioning unit for bull trout). This core area includes the McKenzie and Middle Fork Willamette rivers, and the short stretch of the Willamette River that connects these two subbasins. The Recovery Unit Team identified the Clackamas River Subbasin as "core habitat," which is defined as habitat that could supply all the necessary elements for the long-term security of bull trout, including spawning, rearing, foraging, migrating, and overwintering.

Bull trout were also documented historically in the North and South Santiam subbasins, but these river systems were not designated core habitat in the draft recovery plan because of uncertainties regarding their current ability to support bull trout. The North and South Santiam rivers are considered "research need" areas.

Recovery Goals and Objectives

The overall recovery goal identified in the draft bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the species native range so that the species can be delisted from the ESA. To achieve this goal, the following objectives were identified for bull trout in the Willamette River Recovery Unit:

- Maintain current distribution of bull trout and restore, where habitat is deemed sufficient, distribution to previously occupied areas within the Willamette River Recovery Unit.
- Maintain stable or increasing trends in abundance of adult bull trout.
- Maintain and restore suitable habitat conditions for all bull trout life history stages.
- Conserve genetic diversity and provide opportunity for genetic exchange.

Recovery Criteria

Draft recovery criteria for the Willamette River Recovery Unit reflect the stated objectives, evaluation of population status, and recovery actions necessary to achieve the overall goal. Draft recovery criteria address population distribution, population abundance, population trends, and habitat connectivity.

Distribution criteria will be met when bull trout are distributed among three or more local populations in the recovery unit: two in the Upper Willamette River core area and one in the Clackamas River core habitat. In addition to this feasibility assessment, similar assessments are needed to evaluate the feasibility of reintroducing bull trout into historic habitats in the Middle Fork Willamette River Subbasin (Salt Creek, Salmon Creek, and the North Fork Middle Fork Willamette River) and North and South Santiam subbasins.

Draft abundance criteria will be met when estimated abundance of adult bull trout is from 900 to 1,500 or more individuals in the Willamette River Recovery Unit. The recovered abundance range was derived from the professional judgment of the Willamette River Bull Trout Recovery Unit Team in estimating the productive capacity of identified local populations and potential habitat. These abundance goals may be refined as more information becomes available through monitoring and research.

Trend criteria will be met when adult bull trout exhibit stable or increasing trends in abundance in the Willamette River Recovery Unit based on a minimum of 15 years of monitoring data.

Connectivity criteria will be met when intact migratory corridors among all local populations provide opportunity for genetic exchange and diversity. In the Upper Willamette River core area, meeting connectivity criteria will require the establishment of upstream and downstream fish passage facilities at Cougar, Trail Bridge, Dexter, Lookout Point, and Hills Creek dams.

The Willamette River Recovery Unit and Strategy for Recovery

The combination of core habitat and a core population (i.e., bull trout inhabiting a core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit. Within a core area, many local populations may exist. The Clackamas River is designated core habitat, not a core area, because it currently does not contain any known local populations, but does contain habitat thought to be suitable for bull trout. The Clackamas River Subbasin has been identified as a potential area for reintroducing bull trout. Successful reestablishment of bull trout in the Clackamas River would contribute to meeting recovery criteria for bull trout in the Willamette River Basin by restoring distribution to a previously occupied area, improving the long-term outlook for bull trout recovery in the Willamette River Recovery Unit, and by safeguarding bull trout persistence by spreading potential extinction risks.

The Role of Reintroduction in Recovery

Section 3(3) of the ESA lists artificial propagation and transplantation (or reintroduction) as methods that may be used for the conservation of listed species. While transplantation has played an important role in the recovery of other listed fish species, the overall recovery strategy for bull trout in the Willamette River Recovery Unit, where possible, will emphasize identifying and correcting threats affecting bull trout and their habitat.

However, due to the size of the Willamette River Basin and the extirpation of bull trout in multiple subbasins, transplantation, in addition to the current effort to rehabilitate bull trout in the Middle Fork Willamette River Subbasin, will likely be necessary for bull trout recovery within the Willamette River Recovery Unit. The Willamette Chapter of the draft recovery plan (USFWS 2002) describes several information needs required for transplantation. Transplantation actions will follow the joint policy of the USFWS and the NMFS regarding transplants of listed species (65 FR 56916). Also, an appropriate plan would need to be approved to consider the effects of transplantation on other species, as well as on the donor bull trout population(s). Transplanting listed species must be authorized by the USFWS through a 10(a)(1)(A) recovery permit or other applicable regulatory tools, and methods must meet applicable state fish-handling and disease policies.

Therefore, to achieve recovery in the time frame that is specified in the Willamette Chapter of the draft recovery plan, some form of reintroduction is likely necessary. The current Willamette River bull trout local populations have been isolated and functioning at low abundance for a long period of time. As a result, a program to immediately increase the number of individual fish in the core area and to infuse new genetic material into existing populations to avoid loss of alleles and heterozygosity (Spruell et al. 1999) is warranted. The Willamette Chapter of the draft recovery plan suggests that feasibility assessments should be completed to identify streams with the greatest potential to support local populations of bull trout and to identify the best available source of genetic material (donor population).