Clackamas River Bull Trout Reintroduction

Implementation, Monitoring, and Evaluation Plan

Photo credit: Joel Sartore – National Geographic Stock with assistance from Wade Fredenberg, USFWS

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Table of Contents

1. Background 4
   1.1 Overview 4
   1.2 Project History 4
   1.3 Reintroduction Feasibility Assessment 9
   1.4 Action Area 14
   1.5 Section 10(j) of the ESA 14
   1.6 Geographic Boundaries of the 10(j) Designation 15
   1.7 Project Management Structure 18
2. Reintroduction Plan and Implementation Strategy 19
   2.1 Annual Donor Stock Availability 20
   2.2 Numbers and Life Stages Proposed for Transfer 22
   2.3 Donor Stock Collection and Timing 23
   2.4 Release Locations and Timing 25
   2.5 Pathogen Screening 27
3. Monitoring Strategy 29
   3.1 Monitoring and Evaluation Guidance 29
   3.2 Donor Population Monitoring 30
   3.3 Clackamas Bull Trout Monitoring 32
   3.4 Impacts to Listed Salmon and Steelhead 39
4. Evaluation Strategy 44
5. Timeline, Budget, and Responsible Parties 47
6. References 50
7. Appendices 53
   I. Clackamas Bull Trout Reintroduction IM&E Prioritized Questions 54
   II. Clackamas Bull Trout Reintroduction Summary of Design and Implementation Needs for FY 2011 56
   III. Stepwise Impact Reduction Plan 58

List of Figures

Figure 1. Current and historical distribution of bull trout in the Willamette River Basin

Figure 2. Historical bull trout distribution in the Clackamas River

Figure 3. Suitable Habitat Patches in the Upper Clackamas River

Figure 4. Nonessential experimental population Area in the Upper Clackamas River

Figure 5. Clackamas Reintroduction project oversight committees

Figure 6. Bull trout length frequency during seven months of collections at Round Butte Dam

Figure 7. Principal Components Analysis of the Upper Clackamas subbasin patches

Figure 8. Locations of fixed radio telemetry stations and PIT antennae arrays

Figure 9. The top 35 GRTS sampling points in A) Patch 2 (Pinhead/Last) and B) Patch 4 (Cub/Berry)

Figure 10. Proposed locations of PGE PIT tag antenna and radio telemetry receivers throughout the PGE Hydroproject area

Figure 11. Roles of agencies in collecting fish and performing monitoring activities in 2011

List of Tables

Table 1. Preliminary budget for the first two years of the Project

1. Background

1.1 Overview

Bull trout (*Salvelinus confluentus*) is a species of char native to the Pacific Northwest, and currently occurs in Oregon, Washington, Idaho, Montana, and Nevada. Bull trout require cold, clean water in complex stream habitats, and populations have been negatively affected by several factors including habitat degradation (e.g., Fraley and Shepard), barriers to migration (e.g., Rieman and McIntyre 1995), and the introduction of non-native species trout (e.g., Leary et al. 1993). Consequently, bull trout populations have declined across their native range (Rieman et al. 1997) and were listed as threatened under the Endangered Species Act on November 1, 1999 (64 FR 58910).

Consistent with the U.S. Fish and Wildlife Service's ("Service") Draft Bull Trout Recovery Plan (USFWS 2002), this Implementation, Monitoring, and Evaluation Plan ("Plan") will guide the effort to reintroduce bull trout in an area of its natal range where it has been extirpated. Additionally, the information gained from this experimental reintroduction will be used to inform other bull trout reintroduction efforts in other parts of its historic range.

1.2 Project History

Bull trout were once distributed throughout the Willamette River Valley, including the Clackamas River Basin (Goetz 1989). They were a historical component of the Clackamas native fish assemblage that currently includes both Pacific and western brook lamprey, white sturgeon, coastal cutthroat trout, rainbow trout / steelhead, coho, Chinook, mountain whitefish, and several species of minnow, suckers, and sculpin (USFWS 2002). However, based on extensive surveys (e.g., Eberl and Kamikawa 1992; Zimmerman 1999), bull trout are believed to be presently extirpated from the Clackamas River subbasin (Shively et al. 2007). On November 1, 1999, we published a final rule to list bull trout within the coterminous United States as threatened under the Act (64 FR 58910). This final rule served to consolidate the five separate distinct population segment (DPS) listings into one coterminous U.S. DPS listing. We published a draft recovery plan for the Columbia River, Klamath River, and St. Mary-Belly River segments on November 29, 2002 (67 FR 71439) and the Coastal Puget Sound and Jarbidge River segments on July 1, 2004 (69 FR 39950 and 69 FR 39951, respectively). The draft **recovery objectives** are:

(1) Maintain current distribution of bull trout within core areas as described in recovery unit chapters and restore distribution where recommended in recovery unit chapters;

(2) Maintain stable or increasing trends in abundance of bull trout;

(3) Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies; and

(4) Conserve genetic diversity and provide opportunity for genetic exchange.

Draft **recovery criteria** specific to the Willamette River Recovery Unit follow:

(1) Distribution criteria will be met when bull trout are distributed among five or more local populations in the recovery unit: four in the Upper Willamette River core area and one in the Clackamas River core habitat.

(2) Abundance criteria will be met when an estimated abundance of adult bull trout is from 900 to 1,500 or more individuals in the Willamette River Recovery Unit, distributed in each core area as follows: 600 to 1,000 in the Upper Willamette core area and 300 to 500 in the Clackamas River core habitat.

(3) 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 10 years of monitoring data.

(4) Connectivity criteria will be met when migratory forms are present in all local populations and when intact migratory corridors among all local populations in core areas provide opportunity for genetic exchange and diversity.

Restoring bull trout to historic habitat is a major recovery goal and objective listed in the Service's Draft Recovery Plan (USFWS 2002), 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 four major subbasins, including the Clackamas River (Fig. 1). 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. Reestablishment of bull trout in the Clackamas River will help to achieve distribution in the Clackamas River core habitat (defined as habitat that contains, or if restored would contain, all of the essential physical elements to provide for the security of and allow for the full expression of life history forms of one or more local populations of bull trout) (recovery criterion 1 and recovery objective 1) and will increase abundance of adult bull trout in the Willamette River Recovery Unit (recovery criterion 2 and recovery objective 2).

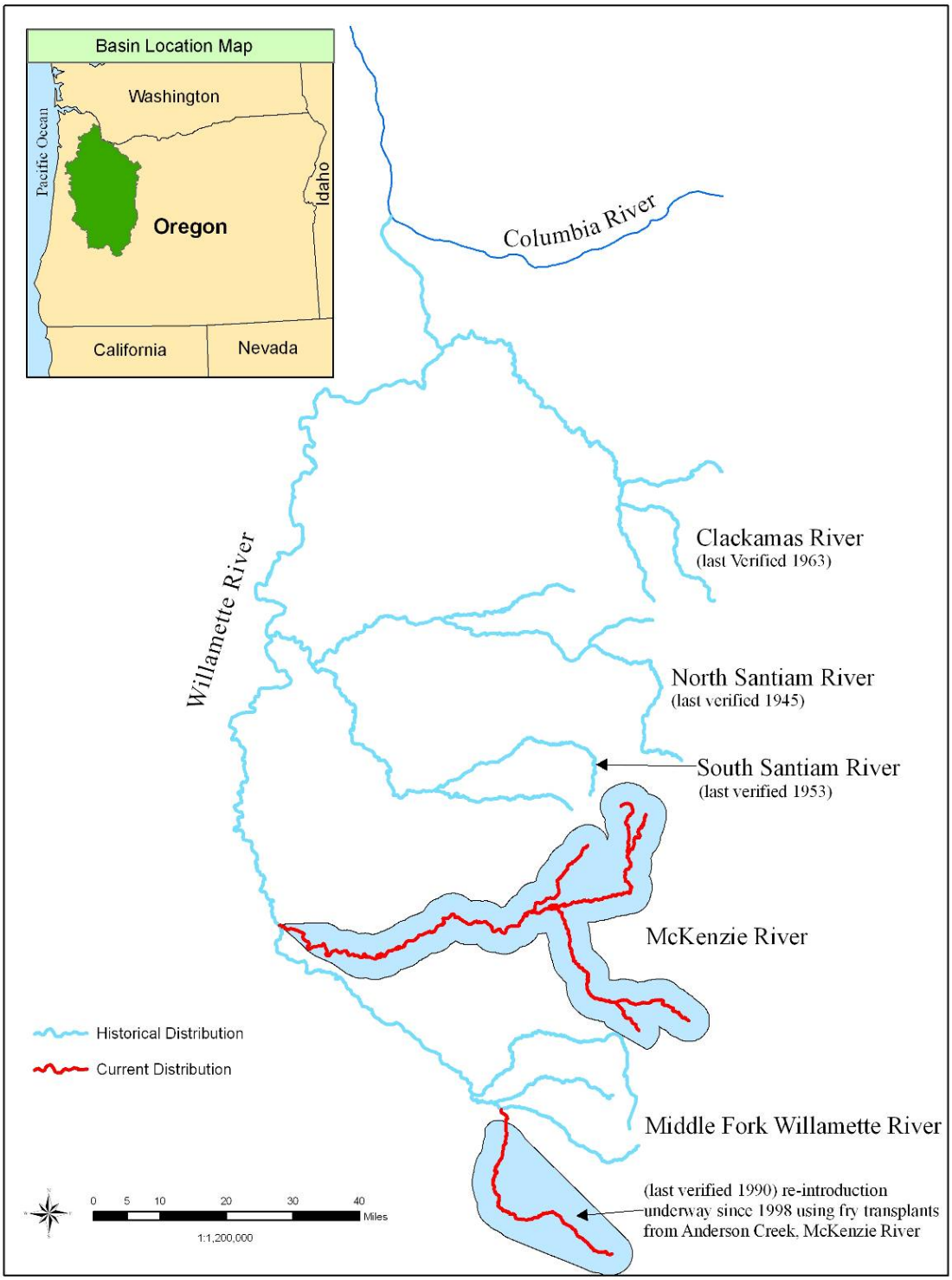

Figure 1. Historical and Current Bull Trout Distribution in the Willamette Basin.

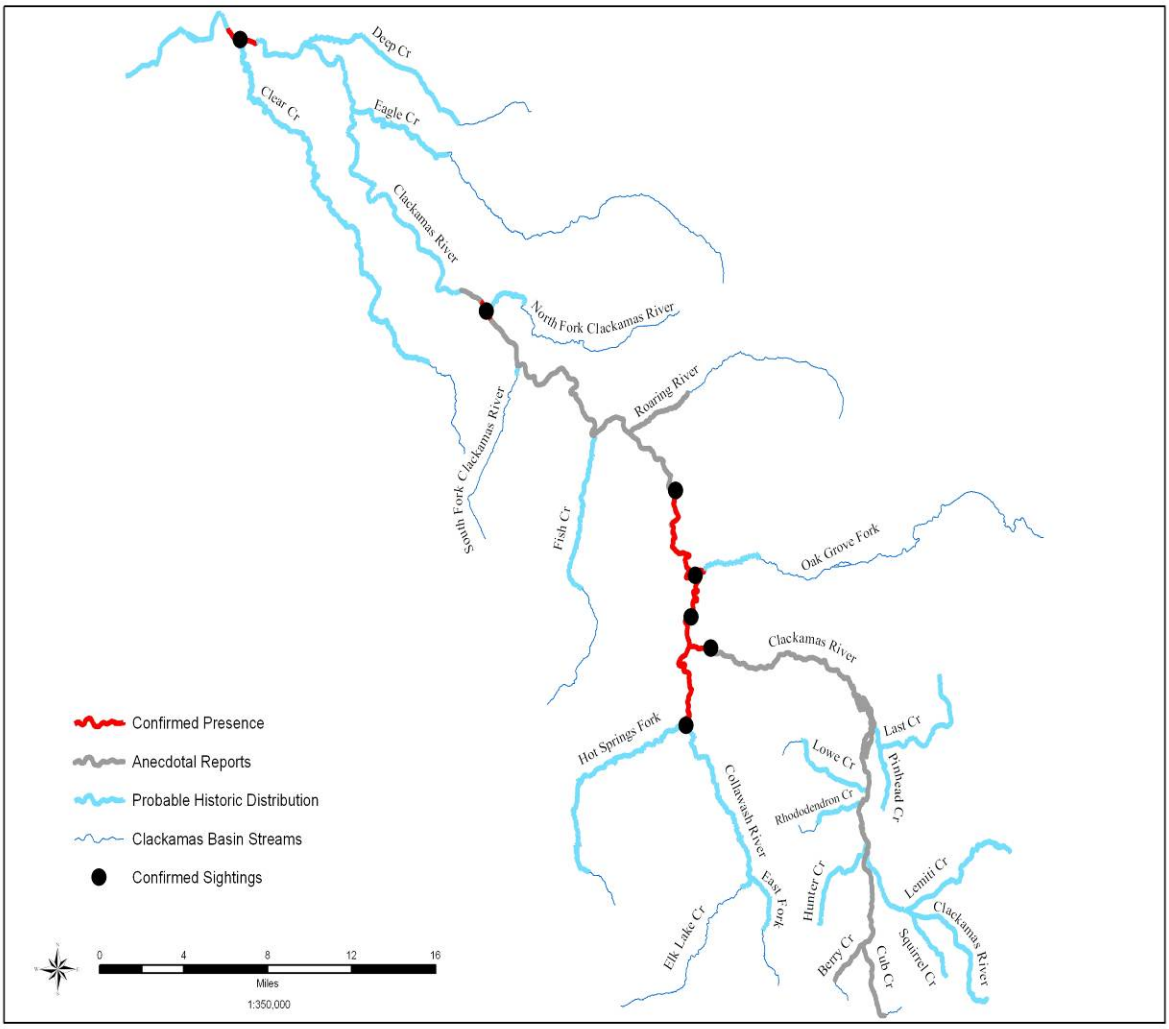

Figure 2. Historical Bull Trout Distribution in the Clackamas River (Shively et al. 2007)

In the early 1990s, fisheries managers from the Oregon Department of Fish and Wildlife (ODFW) and the U.S. Forest Service, Mount Hood National Forest (USFS) recognized bull trout had not been observed in Clackamas River creel surveys for three decades. As a result, a multi-year effort was undertaken in the upper reaches of the watershed to determine if the species was still extant. The effort determined that there was a statistically small probability that bull trout were still present in the upper Clackamas and was consistent with similar efforts to document presence that occurred throughout the mid-to late 1990s. A review by ODFW in 1998 of historical records and anecdotal accounts suggested 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 (Fig. 2). No information is available on historical abundance or the location of bull trout spawning and rearing areas.

Extirpation was likely due to many of the same factors that led to the decline in the species across its range including migration barriers from hydroelectric and diversion dams, direct and incidental harvest in sport and commercial fisheries, targeted eradication with bounty fisheries, and habitat and water quality degradation from forest management and agricultural activities (Shively et al. 2007). The last confirmed record of a bull trout in the Clackamas River was in 1963 although anecdotal reports of observations continued through the early 1970s.

To determine the current suitability of habitat in the Clackamas River Subbasin, and the availability of an appropriate donor stock, a peer-reviewed feasibility assessment was completed by members of the Clackamas River Bull Trout Working Group (CRBTWG) in 2007. The CRBTWG formally convened in 2004, for the purpose of exploring the possibility of reintroducing bull trout into the Clackamas River Subbasin as part of overall recovery efforts for the species. The group is comprised of representatives from the Service, ODFW, USFS, NMFS, U.S. Geological Survey (USGS), and other major stakeholders including Portland General Electric (PGE), Confederated Tribes of the Warm Springs Reservation (CTWSRO), and Confederated Tribes of the Grand Ronde Reservation (CTGRR). The *Clackamas River Bull Trout Reintroduction Feasibility Assessment* (Feasibility Assessment) (Shively et al. 2007) determined that a reintroduction of bull trout into the upper Clackamas River is feasible based on the following factors:

(1) There is a high level of confidence that bull trout have been locally extirpated from the Clackamas River Subbasin;

(2) The causes for their decline have been sufficiently mitigated;

(3) High quality habitat is available in sufficient amounts;

(4) Nearby donor stocks are unlikely to naturally recolonize;

(5) Suitable donor stocks are available that can withstand extraction of individuals;

(6) Nonnative brook trout presence is restricted to a small portion of the suitable habitat and is not a likely threat; and,

(7) A diverse and abundant fish assemblage would serve as a sufficient prey base with no obvious threats posed by bull trout to these species.

Following publication of the Feasibility Assessment (see 1.3 below for more information) the Clackamas Manager's Committee, comprised of managers from the participating agencies/organizations of the CRBTWG, expressed support for moving forward with development of a proposed action, with the Service and ODFW designated as the lead agencies. Concurrently, the Manager's Committee also assessed administrative alternatives for moving the proposed action forward, ultimately electing a federal rule-making process that would designate a reintroduced bull trout population in the Clackamas River as nonessential experimental under section 10(j) of the ESA.

The proposed action was developed in 2008 and 2009, which included joint stakeholder/scoping meetings were conducted by the Service and ODFW in the fall of 2008. On December 9, 2009, we published a proposed rule (74 FR 65045) and draft Environmental Assessment (DEA) (USFWS 2009) prepared pursuant to the National Environmental Policy Act of 1969, as amended (NEPA), which analyzed the potential environmental impacts associated with the proposed reintroduction. The publication of these documents initiated a 60-day public comment period which closed on February 9, 2009.

Based in part on the public comments received, and input and assistance from ODFW, USFS, NMFS, PGE and other project cooperators, the Service is currently developing the final rule and environmental assessment. We are concurrently coordinating with CTWSRO on utilization of Metolius River bull trout as a donor stock for the Clackamas reintroduction. It is our intent to complete these administrative requirements, including issuance of a BO from NMFS to the Service, in the fall and winter of 2010. We plan to begin the transfer of fish from the Metolius River to the Clackamas River in Spring, 2011.

1.3 Reintroduction Feasibility Assessment

The CRBTWG initiated a Clackamas River bull trout reintroduction feasibility assessment in 2004. The Feasibility Assessment focused on the biological feasibility rather than social or economic feasibility, or implications to other species from a reintroduction. In addition, the Feasibility Assessment did not address whether or not a reintroduction should be done or how it should be done. The Feasibility Assessment examined four questions adapted from Epifanio et al. (2003):

(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 currently prevent bull trout from occupying suitable habitats, and have these been corrected?

(3) Is suitable habitat expected reasonably 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?

The following briefly summarizes the primary findings of the Feasibility Assessment:

The CRBTWG has a high confidence that bull trout have been extirpated from the Clackamas River Subbasin because extensive sampling targeting bull trout presence occurred from the 1990s to 2004. The factors leading to the decline of bull trout began in the early 20th Century and extended into the 1970s. The primary factors for their decline include migration barriers from hydroelectric and diversion dams, direct and incidental harvest in sport and commercial fisheries, targeted eradication with bounty fisheries, and habitat and water quality degradation from forest management and agricultural activities. A more detailed explanation of bull trout extirpation in

the Clackamas River Subbasin is provided in Appendix B of the Feasibility Assessment (Shively et al. 2007). The causative factors responsible for the decline and extirpation of bull trout in the Clackamas River Subbasin are believed to be sufficiently remedied so as not to impede or negatively influence the reintroduction effort.

Suitable habitat for bull trout was examined using a tiered approach. Bull trout require very cold water for spawning and rearing. The portion of the Clackamas River Subbasin providing suitable bull trout spawning and rearing habitat today is located in the Clackamas River mainstem and its tributaries upstream of the Collawash River confluence. This portion of the Subbasin contains approximately 70 miles of suitable spawning and rearing habitat configured into six separate habitat patches (Fig. 3). Habitat patches range in size, configuration, and condition. The most downstream habitat patch occurs along the mainstem Clackamas River known as Big Bottom. This unique and complex reach of the river provides suitable spawning and rearing habitat, and would also likely serve as an important foraging area for bull trout. Other habitat patches occur either adjacent to or up to a maximum distance of approximately six river miles upstream into the headwaters of the Subbasin.

The Service has described a method for delineating population boundaries for bull trout that will aid in defining consistent sampling units (i.e., local populations), minimizing the potential for bias, and improve the ability to compare and contrast conditions and trends among recovery units (USFWS 2008). A patch is defined as “the limits or boundaries of environmental conditions that can support a biological response” (Dunham et al. 2002). In the context of bull trout, patches are meant to represent local populations, and are further defined as “a contiguous geographical area that contains the spawning and early rearing habitat used by a bull trout population”.

Habitat patches in the Clackamas Basin were defined as sub-watershed areas containing sufficient quantities of suitable habitat for bull trout spawning and rearing (Shively et al. 2007). In general, patches were identified using a three-step process to determine bull trout spawning and rearing habitat suitability (Shively et al. 2007). First, all historically accessible habitat available to bull trout was identified. Next, small streams (less than 2 m summer low-flow width; i.e., streams in watersheds less than 1742 acres) were removed from consideration. Finally, water temperature criteria were used to refine the focus to smaller, higher elevation river and stream segments within the Upper Clackamas River Subbasin. Streams capable of providing suitable bull trout spawning and rearing habitat generally exhibit maximum water temperature no greater than 15 degrees Celsius. The resulting patch boundaries were developed to reflect watershed boundaries at the 7th field HUC scale; a total of six habitat patches were ultimately identified (Fig. 3).

A donor stock should be comprised of fish that most closely resemble the bull trout that historically inhabited the Clackamas River (e.g., genotype, phenotype, behavior, and life history expression). However, because little is known about the biology and evolutionary history of bull trout that historically occupied the Clackamas River, and no genetic material is available for analysis, the CRBTWG was limited to an assessment of biological information from other local populations, existing studies of the evolution and biogeography of bull trout, information derived from historical harvest data from the Clackamas River, and recent regional bull trout genetic analyses.

Genetic studies of bull trout indicate the existence of at least two major evolutionary lineages; Coastal and Interior (Taylor et al. 1999). Other studies have suggested additional genetic assemblages within the Interior lineage (Spruell et al. 2003, USFWS 2008 unpublished data). By exploring issues associated with life history strategy, metapopulation dynamics, biogeography, and genetic considerations, the CRBTWG identified bull trout populations in the Coastal lineage as the best source for a donor population. Although these local adaptations are important, any of the Coastal lineage bull trout populations are likely to carry the genetic material to preserve and protect the "coastal" lineage regardless of localized and specific adaptations. However, in a further refinement, the CRBTWG determined that donor populations from lower Columbia River tributaries would be most appropriate due to their geographic proximity to the historical bull trout population in the Clackamas River and because genetic studies indicate these populations are more closely related to one another than to other Coastal lineage populations (USFWS 2008, unpublished data). The potential lower Columbia River donor populations of bull trout include fish in five river basins: the Willamette, Hood, Lewis, Deschutes, and Klickitat river basins (Shively et al. 2007, Ch. 3, pp. 8-14). These populations are located a considerable distance away from the Clackamas River Subbasin, and in many cases, the presence of migration barriers makes natural recolonization highly unlikely.

Specific benchmarks have been developed concerning the minimum bull trout population size necessary to maintain genetic variation important for short-term fitness and long-term evolutionary potential. Rieman and Allendorf (2001, pp. 762) concluded that an average of 100 spawning adults each year is required to minimize risks of inbreeding in a bull trout population and that 1,000 spawning adults each year will likely prevent loss of genetic diversity due to genetic drift. This later value of 1,000 spawning adults may also be reached with a collection of local populations among which gene flow occurs. The CRBTWG utilized these general benchmarks in the Feasibility Assessment to assess potential risk to each of the five potential donor stocks in the lower Columbia River from the loss of individuals, recognizing that risk increases as donor populations near 100 spawning adults and diminishes as populations approach 1,000 spawning adults (Shively et al. 2007).

When the Feasibility Assessment was completed in December 2007, bull trout from two of the five river basins, the Lewis River and Deschutes River, contained groups of interacting local populations that exceeded 1,000 spawning adults. For the Lewis River Basin, this included the combined Pine Creek and Rush Creek populations that occur above Swift Dam. For the Deschutes River Basin, this included the three interacting populations present in the Metolius River Subbasin. Since publication of the Feasibility Assessment there have been declines in adult spawner abundance in both the Lewis and Deschutes river bull trout groups, with the Lewis River population dropping significantly in 2007 and 2008, to its current estimated adult spawner abundance of 379 individuals (Doyle 2009). Although the Deschutes River (Metolius River Subbasin) bull trout population has also decreased over the last two years, the CRBTWG considered this population to be the least at risk of the potential donor stocks. Furthermore, per Rieman and Allendorf (2001), the total number of annual spawning adults is sufficiently large enough (approximately 1,000 spawning adults) to protect against the loss of genetic diversity from genetic drift.

Our Feasibility Assessment concluded that there is a high level of confidence bull trout have been extirpated from the Clackamas River and that factors leading to their extirpation have been largely ameliorated. The Feasibility Assessment further concluded that there is sufficient high quality habitat available and a forage base to support a reintroduction, and that the limited presence of non-native brook trout is not a substantial threat. Several suitable donor stocks were identified that could support, with low population risk, the extraction of individuals for translocation to the Clackamas River. Finally, nearby extant populations were determined to be unlikely to naturally recolonize the Clackamas River due to geographic distance and/or isolation due to migratory barriers.

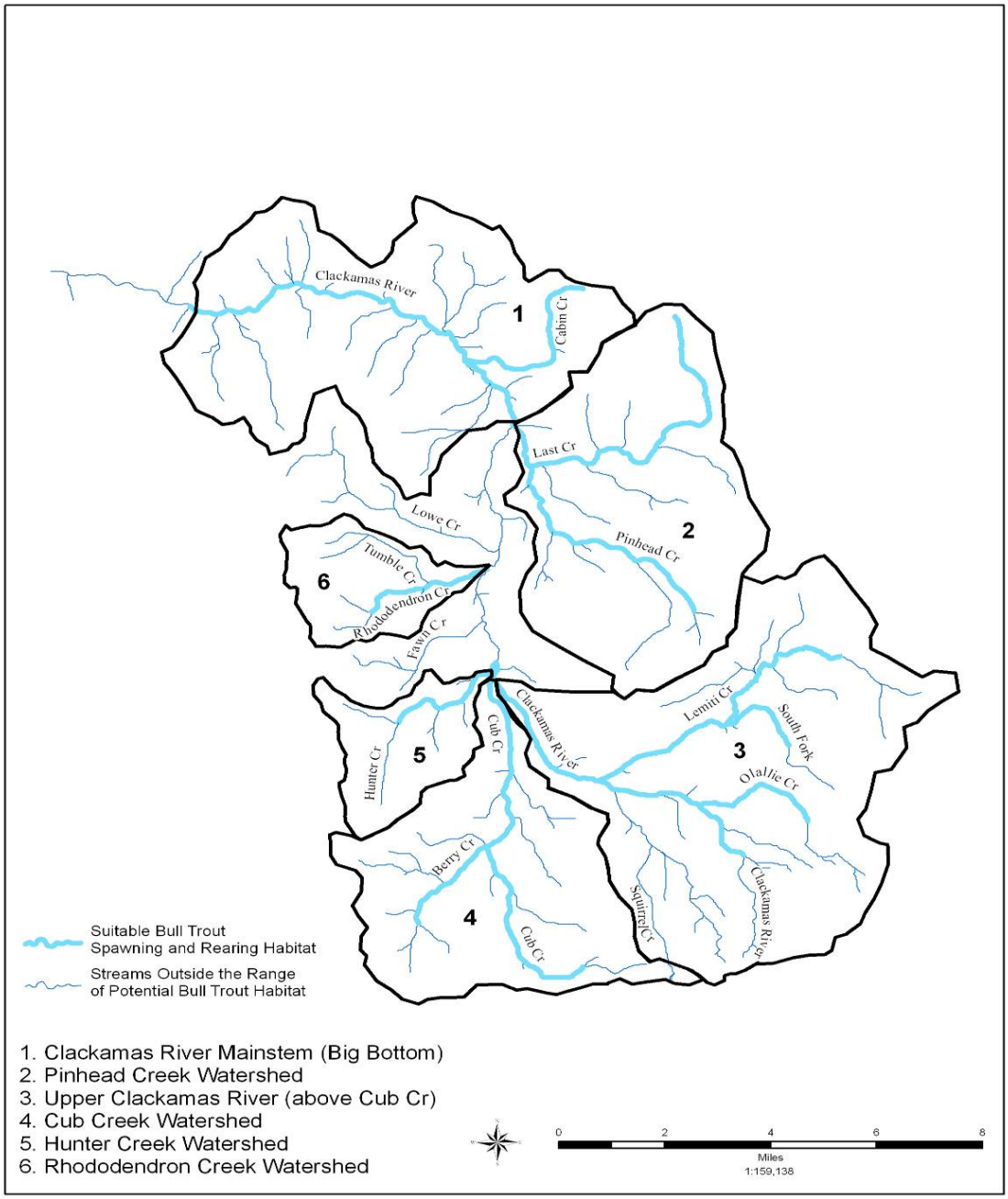

Figure 3. Suitable Habitat Patches in the Upper Clackamas River (*from* Shively et al. 2007).

1.4 Action Area

Although the release sites of translocated fish will be in the upper Clackamas River above the Collawash River confluence, the migratory nature of bull trout suggests the action area should be represented by the entire Clackamas River Subbasin. The exception is the Oak Grove Fork above Timothy Lake Dam. The majority of the Oak Grove Fork watershed was not accessible to bull trout and anadromous salmonids historically due to an impassable natural barrier a short distance below the current dam site.

In addition, we determined during development of the proposed rule on the establishment of a nonessential experimental population of bull trout, that even though the likelihood of bull trout migrating down to the Willamette River is low, it remains a possibility. For that reason, the action area for this consultation follows the 10(j) boundary that includes the Willamette River from Willamette Falls downstream to the confluence with the Columbia River, including the Multnomah Channel (see Section 1.5.6 below for a more detailed description).

1.5 Section 10(j) of the ESA

The 1982 amendments to the Act (16 U.S.C. 1531 et seq.) included the addition of section 10(j) which allows for the designation of reintroduced populations of listed species as "experimental populations." Under section 10(j) of the Act and 50 CFR 17.81, the Service may designate a population of endangered or threatened species that has been or will be released into suitable natural habitat outside the species' current natural range as an experimental population .

Before authorizing the release as an experimental population of any population (including eggs, propagules, or individuals) of an endangered or threatened species, and before authorizing any necessary transportation to conduct the release, the Service must find by regulation that such release will further the conservation of the species. In making such a finding, the Service uses the best scientific and commercial data available to consider: (1) Any possible adverse effects on extant populations of a species as a result of removal of individuals, eggs, or propagules for introduction elsewhere; (2) the likelihood that any such experimental population will become established and survive in the foreseeable future; (3) the relative effects that establishment of an experimental population will have on the recovery of the species; and (4) the extent to which the introduced population may be affected by existing or anticipated Federal or State actions or private activities within or adjacent to the experimental population area.

Under 50 CFR 17.81(d), the Service must consult with appropriate state fish and wildlife agencies, local governmental entities, affected federal agencies, and affected private landowners in developing and implementing experimental population rules. To the maximum extent practicable, 10(j) rules represent an agreement between the Fish and Wildlife Service, the affected state and federal agencies, and persons holding any interest in land which may be affected by the establishment of an experimental population.

The Nonessential Experimental Population (NEP) designation for the reintroduction alleviates landowner and water-user concerns about possible land and water use restrictions by providing a

flexible management framework for protecting and recovering bull trout, while ensuring that the daily activities of landowners and water-users are unaffected. Landowners and managers, and the general public, are more likely to accept bull trout in the Clackamas River adjacent to their lands with the regulatory flexibility provided by a NEP designation. The NEP designation also provides State and Federal agencies flexibility to manage the reintroduced population of bull trout in a manner consistent with the recovery of other ESA-listed species of salmon and steelhead present in the Clackamas River.

Experimental population special rules contain specific prohibitions and exceptions regarding the taking of individual animals. These special rules are compatible with routine human activities in the expected reestablishment area. Section 3(19) of the Act defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Take of bull trout within the experimental population area would be allowed provided that the take is unintentional, not due to negligent conduct, or is consistent with State fishing regulations that have been coordinated with the Service. We expect levels of incidental take to be low because the reintroduction is compatible with existing activities and practices in the area. As recreational fishing for species other than bull trout is popular within the NEP area, we expect some incidental take of bull trout from this activity but, as long as it is in compliance with ODFW fishing regulations, and Tribal regulations on land managed by the CTWSRO, such take will not be a violation of the Act.

1.6 Geographic Boundaries of the 10(j) Designation

The NEP action area, which encompasses all potential release sites, would include the entire Clackamas River subbasin as well as the mainstem Willamette River, from Willamette Falls to its points of confluence with the Columbia River, including Multnomah Channel. The Willamette River's confluence with the Columbia River occurs at river mile (RM) 101, near the City of Portland. A secondary channel of the Willamette River, named the Multnomah Channel, branches off the Willamette River approximately three miles upstream from its confluence with the Columbia River. This secondary channel runs approximately 20 river miles along the west side of Sauvie Island before joining the Columbia River at RM 86 near the town of St. Helen's. The NEP boundary extends down the Multnomah Channel to its confluence with the Columbia River, as well as the mainstem Willamette River from Willamette Falls to its confluence with the Columbia River (Fig. 4).

We define the upper portion of the Clackamas River Subbasin, the area where reintroduced bull trout can be expected to reestablish a viable population, as the headwaters down to and including the North Fork Reservoir (RM 30). Bull trout require cold, clean water in complex river and stream habitats with low levels of fine sediments. These habitat requirements are most stringent for the spawning and rearing life stages of bull trout. The portion of the Clackamas River Subbasin providing suitable spawning and rearing habitat today is limited to the mainstem and its tributaries in the very headwaters of the subbasin upstream of the Collawash River confluence. This portion contains a total of 70.1 river miles of suitable spawning and rearing habitat delineated into six separate habitat patches (Shively et al. 2007). These patches range in size, configuration, and condition. The most downstream patch occurs along the mainstem Clackamas River in an area known as Big Bottom. This unique and complex reach of the river provides

suitable spawning and rearing habitat. The other patches occur either adjacent to or up to a maximum distance of 5.9 river miles upstream into the upper headwaters of the subbasin.

The upper Clackamas River contains a sufficient amount of habitat to support a self-sustaining population of bull trout (Shively et al. 2007). Based on migration patterns and seasonable habitat use observed in nearby extant bull trout populations, such as from the Lewis, McKenzie and Metolius subbasins, it is possible some reintroduced bull trout will utilize North Fork Reservoir. Based on studies and observations of seasonal bull trout movements in other lower Columbia River bull trout populations, it is likely bull trout that overwinter in North Fork Reservoir would migrate upstream into the Clackamas River during spring and early summer.

The Service has broadened the action area beyond the expected reestablishment area to account for individual bull trout that may migrate past major hydroelectric operations on the Clackamas River. If bull trout migrate downstream of North Fork Dam (RM 30), they will do so through one of several mechanisms: via the existing fish bypass system, which deposits fish in the Clackamas River below River Mill Dam at RM 23; through spill over North Fork Dam; or, via entrainment through the turbines at North Fork Dam. The latter two mechanisms would result in bull trout occupying the river reach above Faraday Dam; these fish could move further down the river system via spill at Faraday Dam or through entrainment through the turbine units at Faraday Dam. Both avenues would deposit bull trout in Estacada Lake, the reservoir behind River Mill Dam. Similar to passage at Faraday Dam, bull trout occupying Estacada Lake could potentially migrate to areas below River Mill Dam by: (1) entrainment in spill provided through the recently constructed fish bypass chute to increase passage; (2) entrainment in spill due to large flow events; (3) by entrainment through the turbine units; or (4) by entrainment into the River Mill downstream migrant surface collector (expected completion in 2012).

Although the above information suggests pathways by which bull trout may migrate into the lower Clackamas River below River Mill Dam and into the mainstem Willamette River, we expect the likelihood of this occurrence to be low. Habitat conditions, in particular water temperatures, are not suitable for bull trout for much of the year in the lower Clackamas and Willamette rivers. In addition, observations of bull trout migration patterns and seasonal habitat use in other nearby extant populations suggest reservoirs, such as North Fork Reservoir, often inhibit most bull trout migration to downstream habitats.

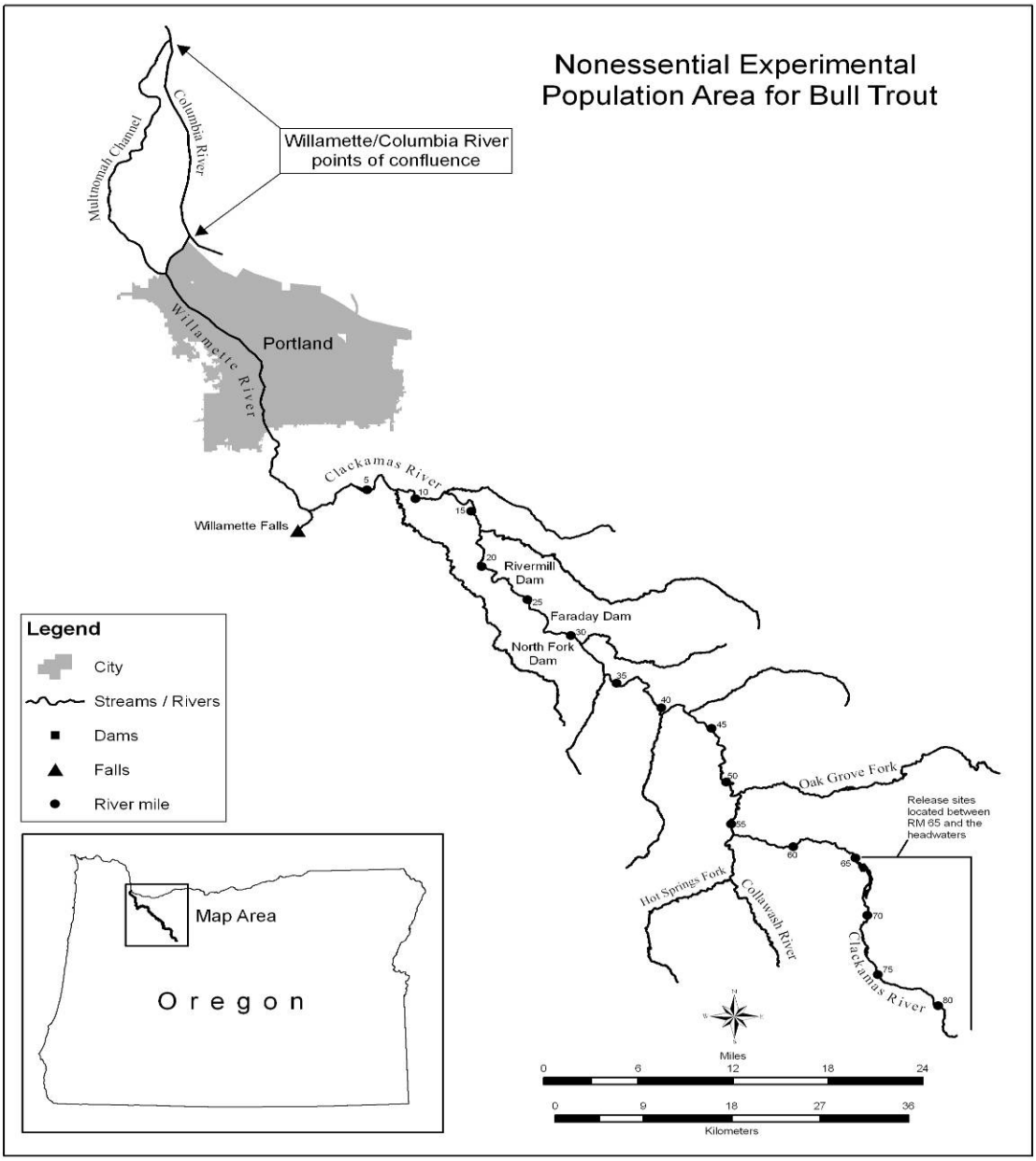

Figure 4. Nonessential Experimental Population Area for Bull Trout Showing Release Locations in the Upper Clackamas River.

1.7 Project Management Structure

The reintroduction project will be guided by two technical committees and a manager's committee (Figure 5). The Clackamas Manager's Committee is represented by the Service, ODFW, USFS, CTWSR, PGE and NMFS. The Clackamas Implementation and Logistics Committee and the Clackamas Monitoring and Evaluation Committee are technical groups represented generally by fisheries biologists from the agencies noted above. Monitoring and evaluation of the project may involve additional entities such as the U.S. Geological Service (USGS) and the University of Washington.

During project planning the Manager's Committee met as frequently as three to four times a year. We expect once we start implementing the project that the committee would, at a minimum, meet annually. The technical committees will be responsible for all detailed and administrative tasks associated with the project including annual planning, disease screening, donor stock capture, tagging, transfer and release, monitoring and evaluation, funding, and annual reporting.

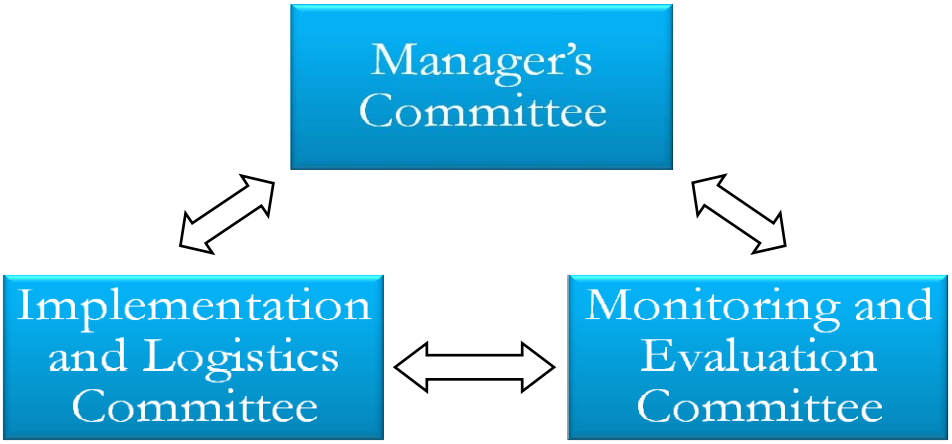

Figure 5. Clackamas Reintroduction Project Oversight Committees

2. Reintroduction Plan and Implementation Strategy

The action is a joint proposal with the State of Oregon to reintroduce bull trout into the Clackamas River. As part of this proposal, on December 9, 2009, we formally proposed designation of a nonessential experimental population of bull trout in the Clackamas River under section 10(j) of the ESA (74 FR 65045). As the primary landowner in the upper Clackamas River where the reintroduction will occur, the USFS Mt. Hood National Forest is our primary cooperating agency, along with NMFS and the CTWSRO, co-manager of bull trout in the Metolius River Subbasin which is the source of our preferred donor stock for the reintroduction.

The goal of the project is to re-establish a self-sustaining bull trout population of 300-500 spawning adults in the Clackamas River by 2030 that contributes to the conservation and recovery of bull trout in the Willamette Basin and to overall recovery criteria outlined in the Draft Bull Trout Recovery Plan (USFWS 2002). For this project we define a self-sustaining population as one that maintains a minimum adult annual spawner abundance of 100 individuals (see Section 1.3 above regarding minimum effective population size), contains a high level of genetic diversity representative of the donor stock, and requires little or no additional transfers. The numerical goal of 300-500 adult spawners is consistent with draft recovery planning targets for abundance (Section 1.1 above). Although the amount of suitable habitat in the Clackamas River suggests there is sufficient capacity to support a population of this size, bull trout distribution across the species' range, even within areas of suitable habitat, is patchy; thus, the true capacity of the Clackamas Subbasin for bull trout is unknown.

To accomplish the project goal, this plan has three objectives relative to project implementation, monitoring, and evaluation:

(1) Ensure that the proposed action does not threaten the donor stock population;

(2) Monitor and evaluate the effectiveness of the bull trout reintroduction strategy for re-establishing a self-sustaining bull trout metapopulation in the Clackamas River; and

(3) Evaluate the effects of bull trout reintroduction on ESA-listed salmonids that currently occupy the Upper Clackamas River Subbasin.

To implement the reintroduction of bull trout to the Clackamas River, we propose to utilize a single donor stock from the Metolius River in Central Oregon. We will collect fish of various life stages (initially juvenile, subadult, and adult) consistent with project numerical goals (see Section 2.1 below) from genetically identifiable groupings of bull trout in the Metolius River. Three major genetic bull trout groupings are present in the Metolious: (1) Whitewater River; (2) Jefferson and Candle Creeks; and, (3) Canyon, Heising, and Jack Creeks.

Due to limited knowledge regarding the status of bull trout in the Whitewater River, and per a request from CTWSRO, we propose to limit potential donor impacts by not targeting individuals specifically in the Whitewater River. However, collections of bull trout from the mainstem Metolius River and Lake Billy Chinook may include some individuals from the Whitewater

River due to the fact they would be physically indistinguishable from bull trout from the other two genetic groupings.

We propose to annually translocate multiple life stages of bull trout directly from the Metolius River to the upper Clackamas River via a three-phased adaptive management approach until either: (1) an evaluation of the program shows the goal of the project has been met or is on a trajectory to be met through natural reproduction based on monitoring and evaluation; (2) mid-process outcome evaluation suggests the reestablishment of bull trout is unlikely (i.e., the project is not showing acceptable levels of success); or (3) evaluation indicates an unacceptable level of impact to other federally listed fish species in the Clackamas River from predation and/or competition. The three phases of the project are outlined below:

> **Phase One (2011-2017):** Phase One of the reintroduction will be the key active management and learning phase. The release strategy varies with the life stage being reintroduced and may be modified as necessary based on monitoring results. Older life stages captured in Lake Billy Chinook or at Round Butte Dam's fish collection facility will be released in the mainstem Clackamas in patch 1 (Fig. 3 above). Juveniles (and fry if utilized in the future) will be released in all suitable patches on a rotating basis.
>
> **Phase Two (2018-2024)**: Based on Phase One monitoring, adaptively manage the implementation strategy to favor more successful life stages and preferred habitat patches. If Phase One is determined to be unsuccessful, reevaluate components of the reintroduction strategy such as donor stock, release locations and timing, life-stages and numbers transferred, to inform whether to significantly modify or discontinue the project.
>
> **Phase Three (2025-2030)**: By the year 2030 (or sooner if the goal and objectives are achieved) discontinue active management and stop implementation. Continue to implement a post-treatment monitoring and evaluation program.

2.1 Annual Donor Stock Availability

The numbers and life stages of donor stock to be transferred from the Metolious River to the Clackamas River were developed by members of the CRBTWG and members of the Deschutes Bull Trout Working Group (DBTWG). The DBTWG includes members that manage and/or contribute to monitoring of bull trout and bull trout habitat in the Metolius River Subbasin (ODFW, CTWSRO, USFS, PGE, Service). Members of these two working groups assembled on March 13, 2008, to discuss and develop donor stock availability criteria that will inform the number of bull trout available on an annual basis from the Metolius River for the first seven-years (Phase 1) of the reintroduction. Members of the Clackamas and Deschutes working groups that met on the issue of donor availability will be subsequently referred to as the donor advisory group.

The donor stock availability criteria, ultimately developed to minimize risk to the donor stock, represent the maximum number of individuals that could be removed annually based on the recent population status of bull trout in the Metolius River. Should the status of bull trout in the

Metolius River significantly change, these criteria will be reevaluated by the Service, ODFW, CTWSRO and other members of the donor advisory group.

Of primary concern to both the Deschutes and Clackamas bull trout working groups is continued viability of bull trout populations within the Metolius River. To that end, the lead implementing agencies of the Project (the Service and ODFW) are committed to an adaptive management framework for the project. All collection of bull trout from the Metolius River will be assessed annually by the donor advisory group.

The advisory group support detailed below is dependent upon the adult spawning population in the Metolius River remaining above 800 individuals annually (based on full census redd counts), including Whitewater River. Maintaining 800 spawning individuals is generally consistent with the donor stock risk assessment in the Feasibility Assessment (Shively et al. 2007) which found low risk (from loss of individuals) to populations that maintain a spawning population size that approaches or exceeds 1,000 individuals. The spawning population estimate peaked in 2004 at approximately 2,500 bull trout but has since dropped to approximately 900 adult spawners in 2008 (does not include Whitewater River bull trout which likely puts the total count over 1,000). If the adult spawning population drops below 800 individuals for a single year, the bull trout co-managers in the Deschutes Basin (ODFW and CTWSRO) and other members of the donor advisory group, will evaluate and provide further guidance to the Clackamas Project as to donor availability by life stage for subsequent years.

Availability of Adult and Subadult Life Stages for Transfer

The donor stock advisory group determined up to a 100 adults and 100 subadults could be available for transfer to the Clackamas River annually provided the total number of adult spawners in the Metolius River maintains 800 or more individuals as called for in recovery criteria outlined in the Draft Recovery Plan (USFWS 2002). For the purposes of our project, we characterize adult bull trout as individuals having spawned at least once or individuals staging for spawning in the Metolius River Arm of Lake Billy Chinook. Information suggests most bull trout in the Metolius River mature at age 5 although there is evidence some mature at age 4. Spawning (i.e., mature) bull trout in the Metolius River range in size from 230-824 mm (9-32 inches) but most are 450-650 mm (18-26 inches) (Ratliff et al. 1996). We define the subadult life stage as individuals two years old or older that have migrated from the Metolius River to Lake Billy Chinook and have not yet spawned. Given that most bull trout in the Metolius River mature at age five, subadult bull trout in Lake Billy Chinook will generally be two to four years of age. Studies suggest annual growth rates in Lake Billy Chinook are variable but generally subadult bull trout in Lake Billy Chinook will range from 150 mm to 450 mm (6-18 inches).

Availability of Fry and Juvenile Life Stages for Transfer

For the purposes of our project we define the juvenile life stage of bull trout as individuals that are age one to age three that are rearing in the Metolius River or tributaries of the Metolius River. Information from Metolius River bull trout studies suggest juvenile bull trout will generally range from 50 mm to 250 mm (2-10 inches).

The donor stock advisory group determined that up to 1,000 juveniles and up to 10,000 fry could be available for transfer to the Clackamas River annually (USFWS 2002), and that take of juveniles and fry is spread among multiple spawning tributaries (excluding direct take of individuals from Whitewater River per request from CTWSRO). In order to transfer as much of the genetic diversity as possible to the Clackamas River we intend to utilize donors from the majority of Metolius River tributaries used by bull trout for spawning. However, the capacity and current number of spawners differs among tributaries and thus if we collect fish from tributaries rather than the mainstem Metolius River, the number of individuals removed from each tributary will be roughly commensurate with the number of adult fish spawning in each tributary. For example, we expect to transfer more donors from Jack Creek which averages more than 150 redds annually then from Heising Spring which averages less than 50 redds annually. Collection of juveniles and fry, if the fry life stage is utilized for the Clackamas reintroduction in future years, will likely occur both in spawning tributaries and in the mainstem Metolius River.

2.2 Numbers and Life Stages Proposed for Transfer

Based on existing donor population levels and donor criteria discussed above, and discussions with the CRBTWG and other project stakeholders, we propose the following approximate numbers of fish by life stage to be transferred each year during Phase 1 of the project. As noted previously, annual monitoring of the donor stock and the reintroduced fish in the Clackamas River will further inform future numbers and life stages for transfer. The numbers and life stages of fish for transfer will be reviewed annually by the donor advisory group, as well as the Implementation Logistics and Monitoring and Evaluation committees associated with the project.

- Adults: Approximately 30 per year (equal numbers of males and females if gender can be identified) for the first 2 years. Continuation through Phase 1 is dependent on monitoring and evaluation results and donor availability. For this project, adults are considered to be greater than 450 mm (18 inches). No fish greater than 650 mm (26 inches) will be transferred to the Clackamas River. Emphasis will be placed on the collection and translocation of adults at the lower end of the adult size range.

- Subadults: Approximately 30 per year for the first 2 years. Continuation through Phase 1 is dependent on monitoring and evaluation results and donor availability. For this project we consider subadults to be fish rearing in Lake Billy Chinook that are 250 mm – 450 mm (10-18 inches) in length.

- Juveniles (age 1, 2, 3): Approximately 1,000 per year. Continue through Phase 1 depending on monitoring and evaluation results and donor availability. For this project we consider juveniles to be fish less than 250 mm (10 inches) that are rearing in the Metolius River or tributaries. No bull trout will be transferred to the Clackamas River that do not meet the minimum size for tagging with a PIT tag (approximately 70 mm for a 12 mm PIT tag).

We are not proposing to utilize fry during the first phase of the project, and their future use is contingent upon the success of older life stages, as determined by monitoring and evaluation. We

are not proposing to utilize fry initially for the following reasons. First, fry inherently have a high mortality rate thus high numbers are required to be transferred to confer survival to reproductive age. Second, fry can't be tagged effectively with current technology. We propose to PIT tag every individual translocated to the Clackamas River for monitoring presence, migration patterns, distribution, survival and growth (when possible). The minimum length at which a fish can be PIT tagged is approximately 70 mm (2.75 inches) which precludes tagging fry. Lastly, to capture the full genetic variability of a spawning population and associated run timing, outmigrating fry in the Metolius River would have to be collected throughout the spring beginning in late February and extending through May. While a large number of fry are captured at the screw trap in the lower Metolius in the spring that would serve this purpose, access to release locations in suitable rearing habitat in the upper Clackamas River is typically blocked by snow until late spring. Therefore fry would need to be temporarily reared in a hatchery environment which is expensive, risks fish mortality, and is labor intensive.

Consistent with the adaptive management strategy of this project, following the initial two years of the project there will be a decision point at which time we will examine whether to continue subadult and adult transfers through Phase 1. The decision point will be informed by monitoring and evaluation and will be based primarily on whether older life stages are adapting and residing in the Clackamas River, and for mature fish, showing indications of reproduction and subsequent recruitment.

2.3 Donor Stock Collection and Timing

As noted above, all donor stock will come from the Metolius River Subbasin and from Lake Billy Chinook. Juvenile bull trout, defined as fish < 250 mm (10 inches), will be collected from the mainstem Metolius River and its tributaries including Jefferson (Tribal permission may be required), Candle, Canyon, Jack creeks and Heising Spring. Juveniles will not be taken directly from Whitewater River but may be collected for donor stock if mainstem Metolius River collections occur. Juvenile collections could occur any time spring through fall but will likely coincide with collections of adults and subadults which are most vulnerable to collection in May and June (D. Ratliff, PGE, personal communication June 2010). Juvenile capture techniques will include minnow trapping, seine netting, electrofishing, dip-netting, collection from the mainstem screw trap, and hook and line angling. Juveniles will be PIT-tagged (see Section 3.3) as close to capture as possible, sorted by size, and placed in live cages (or a hatchery truck on site if necessary) within streams. Juveniles will be held for a maximum of 1-2 days.

In general, adults and subadults would be collected in the Metolius River arm of Lake Billy Chinook when they stage in the late spring and early summer (May and June) prior to migrating into the Metolius River. Collection techniques will be based on methods utilized by personnel on previous bull trout studies at Lake Billy Chinook, namely hook and line angling and Onieda trap netting. If monitoring and evaluation over the first several years of the reintroduction project indicates translocated adults are not remaining in the Clackamas River following a May/June release, or if they remain in the Clackamas River but do not show signs of spawning, then the timing of adult and subadult collections may be revisited by the project technical teams.

An alternative collection opportunity for adult and subadult bull trout now exists given the operation of the new Fish Transfer Facility (FTF) at Round Butte Dam. From early December 2009 through June 30, 2010, over 300 bull trout entered the facility, most of which were 350 mm (13.8 inches) or larger (Fig. 6 below). Six collection tanks associated with the operation of PGE's Round Butte Fish Isolation Facility are capable of holding subadult and adult bull trout (Don Ratliff, PGE, personal communication, July 2010), separated by size, for up to one week. As of April, 2011, adult bull trout have been observed moving through the FTF (Don Ratliff, PGE, personal communication, April 2011). For the first year of translocation, adults will most likely be captured, in part, at the FTF, and all subadults and adults that have been captured and tagged (see below) will be held at the Round Butte Fish Isolation Facility until ready for transport to the Clackamas. Fish will be held for a minimum of five days to ensure that there is no transfer of New Zealand mud snails, an aquatic invasive species that has been found in the Crooked River arm of Lake Billy Chinook.

All fish will be transferred to the Clackamas via a fish transfer truck with a 150 gallon portable tank. Cold water for the tank could be obtained at Wizard Falls, or ice blocks will be used to keep water cold. Fish will be segregated by size, perhaps by using a series of mesh bags, and transported to the Clackamas after any required holding period (for adults and subadults) and then released according to Section 2.4 (below).

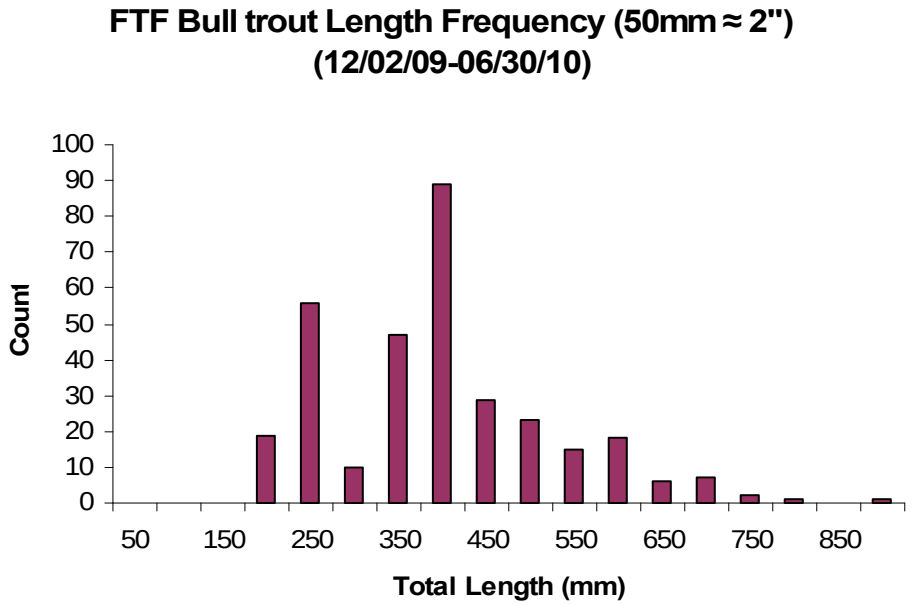

Figure 6. Bull trout length frequency during seven months of collections at Round Butte Dam's Fish Transfer Facility (FTF) (Don Ratliff, PGE, pers. com. 2010)

2.4 Release Locations and Timing

All bull trout will be released in habitat identified in the Feasibility Assessment (Shively et al. 2007) to be suitable for spawning and early juvenile rearing (Patches 1-6 in Fig. 3 above). With the exception of the mainstem Clackamas River habitat in Patch 1, habitat in the remaining patches is not likely suitable for year-round occupancy by adult and subadult bull trout due to stream size. Given the behavior of migratory bull trout in other basins in Oregon and Washington, we do not expect adult and subadult bull trout to be present in the relatively smaller streams in patches 2-6 except during the fall spawning period, typically late August through early October. As a result, and due to the spring and early summer timing of donor stock collection (see 2.3 above), releases of adults and subadults will occur only in Patch 1 or upstream of Patch 1 in the mainstem Clackamas River between Pinhead Creek and Cub Creek. However, bull trout juveniles, and fry if they are utilized in the future, will be released in all suitable streams (over a number of years) within habitat patches 1 thru 6 on a rotational basis (described below).

Given the number of juveniles proposed for transfer on an annual basis (1,000) relative to the amount of suitable habitat available for stocking, and considering factors associated with monitoring these fish, a recommendation was made by the project's technical teams to limit annual stocking to two patches. Due to monitoring considerations, and accounting for annual environmental variability in the receiving habitat and in fish condition, a second recommendation was made to stock the same two patches for a minimum of two, perhaps three years consecutively before shifting stocking to two new suitable patches. We intend to split the number of juveniles equally between the two patches each year; i.e., 500 juveniles will be translocated to each patch. We considered weighing the number of juveniles per patch by catchment size or stream volume, but decided that because there is no evidence that either of those factors would affect habitat suitability in patches there was no reason to do so. At this point, we do not know how many juveniles we will be able to capture for translocation. To prevent too few bull trout from being seeded among two patches (for example, if only 500 juveniles are captured, 250 fish per patch might be too few to measure), we plan on seeding one patch until 500 juveniles are released, and then we will proceed to seeding the second patch.

When releasing juveniles into habitat patches, efforts will be taken to distribute fish as widely as possible (as opposed to releasing them in 1-2 locations), and as far upstream as appropriate. We assume that this will help to minimize intra-specific predation and/or competition. We are initially planning on backpacking juveniles into habitat patches, using approximately 5 gallons of water per backpack, with no more than 15 similarly-sized bull trout per pack. Fish may be separated in small groups between several bags (3-5 groups) within the pack that are individually oxygenated. After reaching a release site, the location of the site will be marked with a GPS and fish will be acclimated to the stream temperature by placing a bag in the stream for several minutes. To maintain dissolved oxygen levels, the bag will be kept closed until fish are ready to be released.

Principle Components Analysis

To avoid arbitrarily choosing the initial two streams/patches for release, and to maximize our probability of reintroduction success by trying different streams within the range of suitable habitats, we conducted a principle components analysis (PCA) that considered differences in habitat variables between each of the upper subbasin patches. We used data collected by ODFW (NEED REF for Shively data) to generate our analysis. We considered maximum water temperature ("Max_Temp"), minimum summer stream width ("Width_ft"), stream gradient ("Gradient_num"), basin area (in acres, "Basin_ac"), and the percent of the basin that fell within the High Cascade (vs. West Cascade) flow regime ("High_Cas"). The PCA generated relationships between each patch and habitat characteristic dimensions. Component loading is a measure of how much a particular variable (gradient, basin size, etc.) corresponds with the component. Dimension (or principal component) 1 is mostly a measure of summer stream width and basin size (both have high positive loadings), as well as gradient (high negative loading). Dimension 2 has large loadings of maximum temperature and percent of the watershed in the high cascades. Together, these two dimensions account for about 72% of the variance between the streams.

Based on where each basin falls relative to each dimension axis (Figure 7), the Cub and Berry patches appear to be similar in that both have higher summer temperatures (i.e., both fall near each other on the dimension 2 axis) whereas Pinhead and Last are also fairly similar but have lower summer temperatures. Rhododendron and Hunter patches are similar based on gradient (dimension 1) but are not particularly close to each other regarding temperature. While the Upper Clackamas patch appears to be distinct, note that the basin acreage is fairly large and includes the Upper Clackamas and Lemiti drainages; data was not available for the Upper Clackamas above its confluence with Lemiti Creek.

In deciding which two patches to initially seed with translocated bull trout, it may be reasonable to choose two patches that are on opposite ends of a PCA axis but that are still characterized by (what we assume to be) appropriate bull trout habitat. In this case, if we choose dimension 2 (which is characterized by maximum temperature and high cascade flow regime), we might decide to use Pinhead or Last Creek for one translocation patch and Cub or Berry Creek for the second patch, as these sites are opposite each other on the dimension 2 axis but still relatively similar in respect to dimension 1.

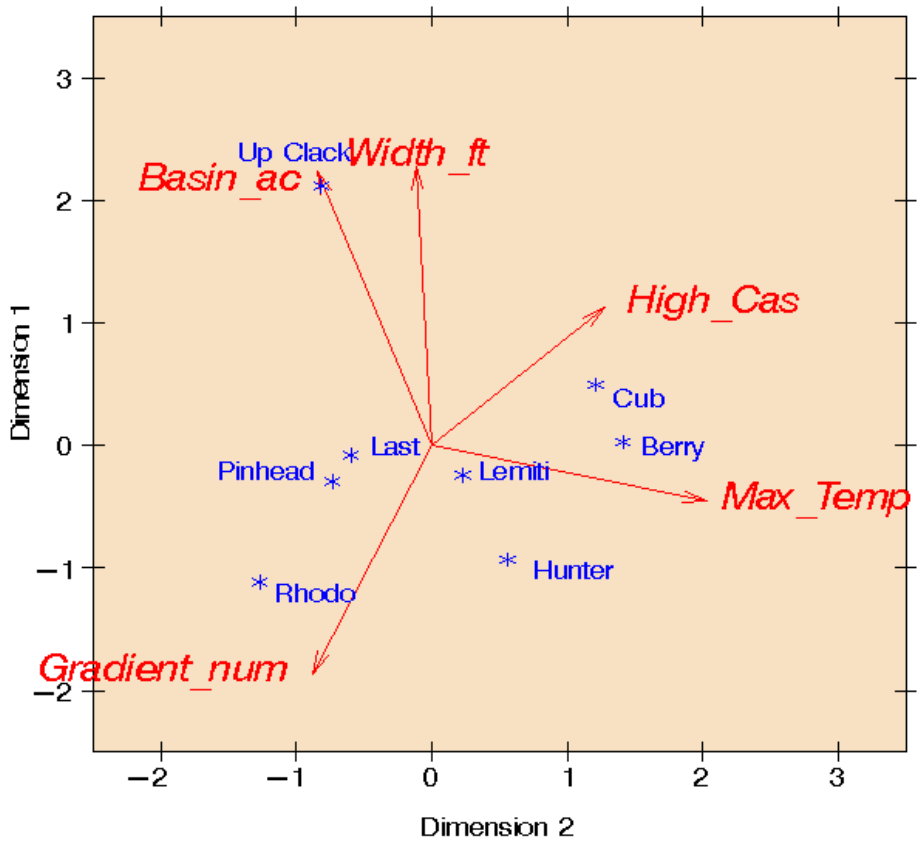

Figure 7. Principal Components Analysis of the Upper Clackamas subbasin patches.

2.5 Pathogen Screening

<u>Annual Protocols for Pathogen Screening</u>

Based on State requirements and recommendations from ODFW Fish Health Services (ODFW 2009), 60 ripe bull trout adults must be tested for virus the fall previous to transfer by collecting (non-lethal) and testing ovarian fluid and sperm. Although not required, it is preferable to have the samples come from individuals from more than one spawning tributary. Testing of adult fluids was initiated in the fall of 2010; 59 adults were tested with negative results for virus. In addition, each year of transfer will also require the testing (lethal) of 150 fry, which will begin in the spring of 2011. Similar to the adult samples, it is preferable to have the samples come more than one spawning tributary. As long as yearly test results for both fry and adults remain negative for IHNV, the project is cleared by ODFW Fish Health Services to collect and transfer any life-stage of bull trout from within the Metolius River/Lake Billy Chinook system that calendar year. The testing, which will occur at Fish Health Services labs in Madras or Corvallis, will provide a 95 percent confidence of pathogen detection at a 5 percent incidence rate for the adult population and 2 percent incidence rate in the fry.

The two samples are temporally separated but offer the best possible life-stages from which to pick up the virus. Clearance of the population would have to occur on an annual basis such that the results of adults sampled in the fall are combined with results of fry testing from the following spring to clear the population for transfer during that year. For example, if adults are tested in the fall of 2010 and fry in early 2011, with no virus detected, then any life-stage of bull trout can be transferred to the Clackamas River that calendar year (2011).

Baseline Pathogen Assessment

Unwanted pathogens and diseases have occasionally been introduced through fish transfers (Hoffman and Schubert 1984). To avoid these unintended consequences, translocations of fishes between major river basins should be preceded by a thorough investigation into the potential transfer of pathogens from the donor source, as well as the resistance of the donor stock to any known pathogens present in the receiving habitat.

In order to assess and minimize the risk of pathogen transfer and the presence of pathogens in the Clackamas River we worked closely with ODFW Fish Health Services and staff from the Service's Lower Columbia River Fish Health Center. Our pathogen assessment utilized existing information from the Deschutes Basin (and Metolius subbasin) and new information that was collected from the Clackamas and Lewis rivers as part of the pathogen assessment. At the time of the assessment bull trout from the Lewis River, in addition to bull trout from the Metolius River, were being considered as potential donor stock for a reintroduction to the Clackamas River.

The results from our testing of fish from the Lewis and Clackamas rivers, combined with existing data from the Deschutes Basin (Engleking 2003) provided valuable information regarding (1) the risk of pathogen transfer to the Clackamas River from the Metolius or Lewis river donor stock; and, (2) the presence or absence of pathogens in the Clackamas River that may influence the health of donor stock from the Lewis or Metolius rivers. Based on the results, it appears the predominant pathogens of concern to a reintroduction of bull trout to the Clackamas River are Infectious Hematopoietic Necrosis Virus (IHNV) and *Renibacterium salmoninarum* (the causative agent of Bacterial Kidney Disease, BKD). The State's expressed primary concern is introducing U-clade IHNV to the Clackamas River. U-clade INHV is present in the Deschutes Basin but has not been detected in bull trout from below or above the Pelton-Round Butte Project.

Based on our pathogen assessment there is no evidence that pathogens from potential donor stock or from the receiving environment will compromise the success of the reintroduction project. In addition, there does not appear to be undue risk to other native salmonids in the Clackamas River from a transfer of bull trout from either the Lewis or Metolius rivers. Despite these findings, annual pathogen screening of a representative sample of bull trout prior to transfer to the Clackamas River is warranted.

3. Monitoring Strategy

The purpose of this project's monitoring and evaluation program is twofold; 1) to assess the effectiveness of the reintroduction to inform the adaptive management of the project (i.e., refine the implementation strategy and apply appropriate management); and, 2) to document the effectiveness of the reintroduction strategy and learn from the results of our actions so that we can apply our increased knowledge elsewhere. The monitoring program has three major objectives:

(1) Ensure that the proposed action does not threaten the donor stock population;

(2) Monitor and evaluate the effectiveness of the bull trout reintroduction strategy for establishing a self-sustaining bull trout metapopulation in the Clackamas River; and

(3) Evaluate the effects of bull trout reintroduction on ESA-listed salmonids that currently occupy the Upper Clackamas River Subbasin.

The monitoring strategy will use an adaptive management approach; that is, future monitoring and evaluation actions will depend upon, and be informed by, what is learned as the project is implemented. Additionally, information gained from the monitoring and evaluation program will be used to guide management actions to ensure that neither the donor stock nor listed anadromous salmonid populations in the Clackamas basin suffer significant negative impacts as a result of bull trout reindroductions. Because there are many possible results in response to our actions, this plan will focus on the first phase of this project (years 1 – 7) to guide our monitoring and evaluation strategy. As we move through Phase 1, the results we observe will guide us towards a continued monitoring and evaluation strategy in Phase 2 and beyond. Subsequently, this plan identifies prioritized study questions and monitoring techniques for Phase 1, and what we believe will be relevant study questions in Phases 2 and 3 of project implementation (see Appendices 1 and 2 for a summary of prioritized questions and monitoring strategies).

3.1 Monitoring and Evaluation Guidance

As part of the overall responsibility of designing an effective monitoring and evaluation program for bull trout, the USFWS has established the Bull Trout Recovery Monitoring and Evaluation Technical Group (RMEG) (USFWS 2008). The bull trout RMEG is a multi-agency body chaired by USFWS fisheries technical staff and independently facilitated. The group consists of several members representing a balance of skills in population dynamics, char biology, field studies, biometrics, and experimental design. The USFWS has asked the RMEG to undertake the following tasks: 1) summarize bull trout monitoring and evaluation needs, 2) review analytical methods of characterizing bull trout population and habitat status, 3) increase the utility of current data collection for recovery planning, 4) direct and prioritize future monitoring efforts associated with bull trout recovery, 5) develop and standardize design elements, and 6) foster coordination among monitoring programs.

The RMEG has begun to address monitoring and evaluation components related to all four Recovery Plan objectives: distribution, abundance/trends in abundance, habitat conditions and

genetic diversity/exchange. Initial RMEG efforts have focused principally on distribution questions, with more recent efforts targeting abundance and connectivity (habitat condition and genetic exchange). The intent of the RMEG is to provide guidance and support to bull trout recovery efforts in three primary areas: 1) monitoring design; 2) specific monitoring techniques; and 3) analytical methods for assessing recovery.

This Plan identifies guidance recommended by RMEG (USFWS 2008) to evaluate the presence / absence of reintroduced bull trout in Upper Clackamas habitat patches, monitor their distribution and movement, and assess reproduction. These aspects will be discussed further below.

3.2 Donor Population Monitoring

Two questions guide monitoring of the Clackamas reintroduction donor population in the first phase of the reintroduction project:

D1. Does the donor stock population have the minimum threshold number of spawning adults required to continue donor stock removal?

D2. Is the donor population is pathogen-free?

Pathogen screening (addressing D2) is described in detail in section 2.5 of this plan. To address question D1, the Clackamas bull trout reintroduction is dependent upon the adult spawning population in the Metolius River remaining above 800 individuals annually. The spawning population estimate peaked in 2004 at approximately 2,500 fish but has since dropped to approximately 900 adult spawners in 2008 (this estimate does not include Whitewater River bull trout). If the adult spawning population drops below 800 individuals for a single year, the bull trout co-managers in the Deschutes Basin (ODFW and CTWSR) and other members of the Advisory Group will evaluate and provide further guidance to the Clackamas Project as to donor availability by life stage for subsequent years.

Monitoring the donor population is necessary to detect any deleterious effects from removal of individuals and also to serve as a guide for the number of fish available for the reintroduction program. Current population monitoring by ODFW, USFS, CTWSR and PGE consists of redd surveys throughout the Metolius subbasin, creel surveys in Lake Billy Chinook, operation of a screw-trap for outmigrant monitoring in the Metolius River at Monty Campground, and juvenile bull trout density monitoring at index reaches in spawning streams (USFWS 2002). Bull trout in the Metolius River are monitored primarily by annual fall census redd counts (USFWS 2002). A fish-to-redd conversion factor derived from mark-resight studies in the Metolius River is used to estimate the annual adult spawning population size (Ratliff et al. 1996). This conversion factor was initially generated in the 1990s and is currently being tested in the field, with Service financial support in 2009 and 2010 (ODFW, pers. comm. 2011). These monitoring programs, which have occurred for almost two-decades, will continue into the future and be used to evaluate the donor population.

The donor stock availability criteria, ultimately developed to reduce the potential impact to the donor stock, represent the maximum number of individuals that could be removed on an annual

basis based on the recent population status of bull trout in the Metolius River. Should the status of bull trout in the Metolius River significantly change (including genetic health, see below), these criteria will be reevaluated by the Service, ODFW, CTWSR and other members of the Donor Stock Advisory Group. All take of bull trout from the Metolius River will be assessed every year at an annual meeting of the Donor Stock Advisory Group.

A third question, which may be addressed more explicitly at the end of Phase 1 or at the beginning of Phase 2 (pending resource availability), is D5: Are there any indications of deleterious impacts (genetic fitness or population abundance) to the donor population from removing individuals for translocation (see Appendix 1)? Genetic assignment techniques (Anderson et al. 2008) can be used to monitor impacts to the donor population. Genetic monitoring of the Metolius will help to determine if any spawning populations show a decrease in levels of genetic variation, experience a genetic bottleneck, or show a decrease in effective population size. A Metolius River bull trout baseline genetic analysis was conducted in 2008 by the Service's Abernathy Conservation Genetics Lab (DeHaan et al. 2008). This analysis utilized collections of approximately 50 juvenile bull trout from each of seven Metolius River spawning tributaries. Using the genetic baseline dataset, adults and subadults collected in Lake Billy Chinook, along with any other individuals of unknown origin, can be assigned to their population or spawning complex of origin. This will allow us to determine the proportion of adults transferred to the Clackamas that originate from each population/spawning complex. This analysis will be particularly useful for assessing the direct impact of the reintroduction program on the Whitewater population since fish from Whitewater River can be assigned with a high degree of confidence.

Genetic samples will be collected and stored at Abernathy Fish Technology Center throughout Phase 1 in anticipation of addressing this question later in the monitoring and evaluation program. We expect to repeat an analysis similar to that conducted in 2008 in the future at appropriate intervals (every 5-7 years, likely to occur at the end of Phase 1 or early in Phase 2) to ensure the contribution of individuals to the Clackamas River is not reducing the genetic fitness (i.e., allelic frequencies) of Metolius River bull trout donor stock. Although juveniles will not be collected from the Whitewater River for transfer to the Clackamas, collections for genetic monitoring of the Metolius spawning tributaries should also include individuals from the Whitewater River so that any impacts to this population can be documented; this may require additional tribal approval. It will be important to separate fluctuations in genetic variation that occur naturally from those that may result from transferring fish from the Metolius River to the Clackamas River. Fin clips collected from the first few years of juveniles transferred to the Clackamas River should provide the appropriate baseline genetic samples to examine natural fluctuations in genetic variation in the Metolius River. This analysis will help determine if any changes observed in genetic variation once transfers begin are greater than what we might expect due to natural annual fluctuations. Should the genetic health of bull trout in the Metolius River significantly change the status of the Metolius bull trout population will be reevaluated by the Service, ODFW, CTWSR and other members of the Donor Stock Advisory Group to determine whether removal of bull trout from the Metolius is still appropriate.

3.3 Clackamas Bull Trout Monitoring

As stated in Section 3, the purpose of this monitoring program is to 1) to assess the effectiveness of the reintroduction to guide adaptive management of annual project implementation, and 2) to document the effectiveness of the reintroduction strategy and learn from the results of our actions. While there are an abundance of interesting questions that we could ask, there are four primary questions that guide the monitoring of reintroduced bull trout in the Upper Clackamas Subbasin during Phase 1 (see Appendix 1), which are described in detail below:

B1. Older life stage retention: do translocated adult and subadult bull trout remain in the upper Clackamas Basin (above River Mill Dam)?

a. If yes, what is their seasonal distribution?
b. If yes, is there evidence of spawning activity? If no, does changing the release timing/location provide a different result?

B2. Juvenile life stage retention: do juveniles remain in the habitat patches they are outplanted to in the short-term or do they move relatively quickly out or into other habitat patches?

a. If they stay, how are juveniles distributed within tributaries?

B3. Reproduction: which translocated life stages are successful in contributing naturally produced progeny in the Clackamas River?

a. Do adults and subadults produce progeny in years 1-3 (and beyond, if applicable)?
b. Do translocated juveniles mature to produce progeny in years 4-7?

B4. Genetic diversity: is the level of genetic variation in the donor population adequately represented by translocated fish (measured in years 4-7 of Phase 1)?

For the initial phase of the project (2011 – 2017), the primary components of our monitoring program will be focused on answering the above questions. We plan to monitor distribution and movement of all translocated life stages, document evidence of successful reproduction (if any), and assess genetic diversity (as measured against the donor population). Monitoring activities in Phases 2 and 3 will be informed by Phase 1 monitoring and evaluation. Monitoring of translocated bull trout will be conducted jointly by the Service and ODFW, with assistance from the USFS and potentially USGS and the University of Washington.

3.3-a Older life stage retention (B1)

Movement and distribution of subadult and adult bull trout will be monitored intensively through the first phase of the reintroduction. During this phase, all translocated subadult and adult bull trout will be implanted with a 23 mm, half-duplex Passive Integrated Transponder (PIT) tag and a small (2 mm^2 – 1cm^2) fin clip will be taken. At the same time, all subadults and adults will

also be implanted with radio transmitters for at least the first two years of the project. Tagging will occur upon collection from Lake Billy Chinook in May and June of each year subadults and adults are to be translocated, starting in 2011. Radio transmitter models will be selected for maximum battery longevity with the constraint that the weight of the transmitter will only be approximately 2% of the body weight of the fish. Given the expected fish sizes, radio tags should be able to last 2-4 years. The need to transfer subadults and adults and radio tag fish in subsequent years will be assessed based on the results of the first two years of monitoring.

Monitoring of subadult and adult movement and distribution will involve radio fixed stations and stationary PIT antennas (which will be installed in the spring of 2011 at key locations described below), and mobile radio telemetry tracking. If most subadult and adult bull trout leave the upper Clackamas River and do not return, we will have strong evidence that these life stages are not effective for reintroduction. To investigate this, a radio fixed station will be located immediately below the River Mill Dam and a PIT antenna will be installed in the PGE downstream by-pass facility (see Figure 8). In combination, the two detection methods should have a high likelihood of recording subadult and adult bull trout leaving the introduction area.

If subadult and/or adult bull trout stay within the introduction area, it will be important to know a) how they distribute seasonally, and b) if they migrate to suitable spawning habitats in the fall. Again, we intend to collect data using radio and PIT tracking. Fixed radio stations will be strategically located to monitor fish movement in key sections of the Clackamas River (Figure 8). The sections include (in order of priority) 1) PGE project between River Mill Dam and North Fork Dam, 2) North Fork Reservoir, 3) Clackamas River between NF Reservoir and the Collawash River, 4) Clackamas River between the Collawash River and Pinhead Creek, and 5) Clackamas River and tributaries upstream of Pinhead Creek. In addition to the radio receivers, stationary PIT antennas will be located near the mouth of each of the major tributaries identified as a suitable reintroduction patch (Shively et al. 2007). PIT antennas will be located at the confluence of Last and Pinhead creeks, Cub Creek and the Clackamas River, on Hunter Creek, and on Rhododendron Creek. Readers will have multiple antennas to increase overall detection efficiency and to indicate movement direction when fish are detected at both antennas.

After radio fixed-stations and PIT tag arrays are installed spring 2011, data will need to be uploaded every 7-10 days once fish are in the system (may be less frequent in the winter months, depending on fish movement). Teams that upload data will also ensure that these stations and antennas are in good working order with an adequate power source. In addition to movement and distribution data collected from these fixed locations, stationary radio and PIT detections will be analyzed regularly to direct mobile tracking efforts. Mobile tracking to detect subadult and adult movement will occur in conjunction with summer ground-based surveys to detect the presence of juveniles and/or naturally produced progeny (described in detail below), starting in 2011 and continuing each year through the end of Phase 1. From August through October each year, we will use mobile tracking to search for evidence of spawning activity with the ultimate goal of observing bull trout redds or actively spawning fish.

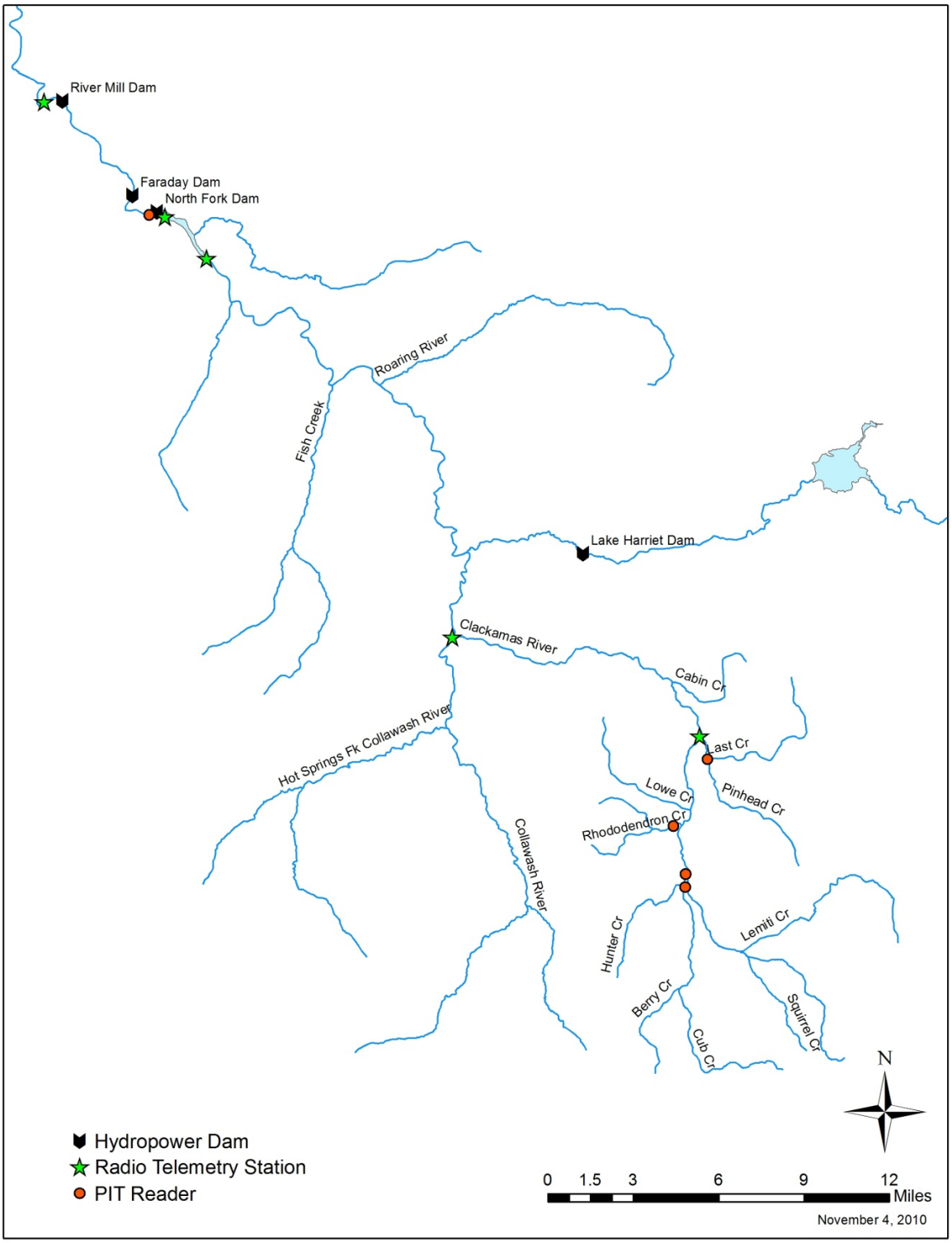

Figure 8. Locations of fixed radio telemetry stations and PIT antenna arrays

3.3-b Juvenile life stage retention (B2)

Upon reintroduction of juvenile bull trout into the upper Clackamas subbasin, we will assess whether juveniles remain in the tributary streams they are outplanted to in the short-term or if they are moving relatively quickly out of or into other tributaries. If juveniles remain in upper basin tributaries, we will also monitor to determine how they are distributed within the tributaries. To assess this, we will monitor juveniles in two ways: 1) the use of PIT-tags and antennae array reader stations, and 2) ground-based presence/absence surveys.

Upon collection from the Metolius basin and prior to release in the Clackamas River, all bull trout between 70 and 120 mm in total length will be PIT tagged using 12 mm half-duplex tags. Juveniles greater than 120 mm will be PIT tagged using 23 mm half-duplex tags; all PIT tags will be placed in the body cavity of fish less than 300 mm by ODFW staff (and assisted by USFS and/or USFWS as available). At this same time a small (2 mm^2 – 1cm^2) fin clip will also be taken from all juveniles for genetic analysis. At least one fixed PIT tag antenna array will be placed in the habitat patch where juvenile bull trout are released, with the primary array stationed just above the confluence of the main patch drainage and the mainstem Clackamas River (see Figure 8; locations of antennae arrays are also described in section 3.3-a). Placing antennas in these locations will provide information on movement between patches.

The goal of presence and absence monitoring is to document the distribution and relative survival of translocated juvenile fish (i.e., determine whether at least some juvenile bull trout survived the translocation and are surviving in new habitat) and to detect any progeny that may result from translocated individuals. The focus of this monitoring component is on the juvenile life stage since older life stages will be radio tagged and thus their status should be readily obtainable during the years the tags are operational (at least years 1-4 of Phase 1). Monitoring the presence and absence of juveniles (including any progeny) will occur by quantifiable methods including electrofishing and/or snorkel surveys, and PIT tag detection systems.

RMEG outlined a protocol for assessing bull trout patch occupancy (USFWS 2008). Patches are intended to represent the area of spawning and early rearing for a population. A population is considered “present” if multiple age classes of pre-migratory juvenile or resident bull trout are found (USFWS 2008). RMEG guidance suggests that the presence of adult bull trout and at least two bull trout redds must be observed at a site to indicate that spawning occurred (USFWS 2008). In the case of the Clackamas reintroduction, we are not necessarily interested in the need to assess the presence of multiple age classes but are more interested in determining whether outplanted juveniles occupy any particular areas within a patch. The goal of the approach is to balance the ability to make statistical inferences about patch occupancy with the realities of logistical and financial constraints. The RMEG approach to evaluating patch occupancy requires an assumed or estimated site-specific detection probability for the sampling method utilized, the probability of presence (given no detection) deemed acceptably low, and the random identification of spatially-balanced sample sites to achieve a sample framework that allows for estimation of presence and the refinement of detection probabilities (USFWS 2008). Assessing patch occupancy requires the following steps, which we have modified (where noted) to suit our specific needs:

1) **Identify a habitat patch.** Habitat patches have been delineated in the Upper Clackamas Subbasin (Fig. 3) based on access to suitable habitat, stream size, and maximum temperature.

2) **Utilize a GRTS design to generate sampling sites within the patch.** The Generalized Random Tessellation Stratified (GRTS) design will generate numerous random, spatially balanced sampling sites (i.e., 50 m reach, with an average density of one site per 500 m of stream) in a specific order. Using an assumed site detection probability, the number of sites to sample should be determined (see Fig. 3.1 in the RMEG guidance document, USFWS 2008). The top 35 GRTS sampling points have been identified for each of the upper Clackamas basin habitat patches (M. Hudson, personal communication, 2010).

3) **Conduct reconnaissance surveys to evaluate the viability of selected sample sites.** If any of these sites are ineligible (e.g., the site is dry, less than 1 m wide, over 18% gradient, etc.), evaluate the next site that was generated by the GRTS design. Repeat until the number of eligible sites required for sampling are selected.

4) **Select a field protocol to apply at each site.** We anticipate that most surveys will consist of electrofishing to detect juveniles, and snorkeling (at night, when possible), as the possibility of progeny in the system increases.

5) **Sample each site for juvenile or YOY bull trout.** Typically, sites would be sampled until there is evidence that the patch is occupied, or until all sites are sampled with no evidence of occupancy. However, in our case, we wish to determine which habitats within patches are suitable and being used by juvenile and/or YOY bull trout. We will survey all sample sites identified in the habitat patch, regardless of whether bull trout are detected or not. If electrofishing is used in the surveys, all captured bull trout will be identified with a PIT tag reader (if tagged), measured (to estimate growth), and its location noted.

6) **Estimate probability of presence if all random sites are sampled and bull trout are not found.** If no bull trout are detected, the probability of presence (given no observations) will be estimated using the procedure of Peterson and Dunham (2003). This will help us determine whether or not using juveniles as part of the reintroduction strategy is appropriate, at least during the initial few years that juveniles are translocated.

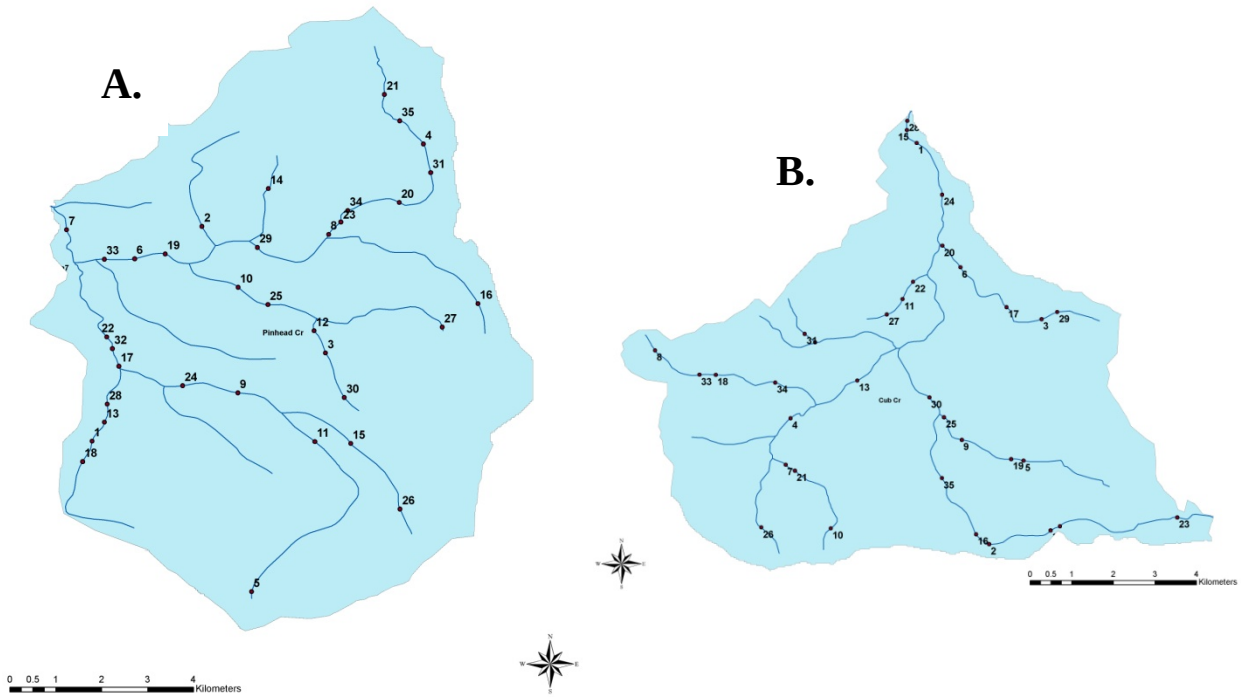

Figure 9. The top 35 GRTS sampling points in A) Patch 2 (Pinhead/Last) and B) Patch 4 (Cub/Berry)

While sampling for presence/absence surveys may detect juvenile bull trout and/or young-of-year progeny in habitat patches, we will also use these surveys to determine where in patch tributaries fish are distributed. Standard habitat characteristics (e.g., water temperature, substrate type, stream width, flow velocity, etc.) at each sampling location will be recorded in order to make inferences about which habitats are preferred for spawning, rearing, and/or migration by fish that remain in the system.

Presence/absence surveys will occur throughout the summers every year in Phase 1. It is likely that presence/absence surveys will occur primarily in the patches to which juveniles are initially translocated. However, if PIT tag data indicates that fish are moving into other patches, additional sampling may be performed in patches that fish are moving to. PIT tag data may also indicate that juvenile bull trout are leaving the upper Clackamas basin habitat batches and moving downstream. In 2011, PIT tag detectors will be installed by PGE at the North Fork Reservoir surface collector, in several locations in the juvenile migrant pipeline, and at the Downstream Migrant Sampling Facility (Figure 10). If juvenile bull trout continue downstream, it is likely that they will be detected at one of these locations; if they are not detected, we will continue to collect PIT tag data to determine if they rear at a location upstream from the PGE hydroproject area then return to the upper basin during seasonal migrations.

3.3-c Bull trout reproduction (B3)

Documenting successful reproduction is a major benchmark in the overall goal of establishing a self-sustaining population of bull trout in the Clackamas River. To inform this and other reintroduction programs, we wish to determine which translocated life stages successfully contribute naturally produced progeny to a re-established bull trout population in the Clackamas River. Documenting potential indicators of reproduction of translocated subadults (when mature) and adults will occur initially (in years 1-4 of Phase 1) by monitoring PIT and radio-tagged individuals to assess upstream movement in the late summer and fall, starting in 2011. Detections of bull trout moving into tributaries would trigger a subsequent effort to document: 1) the existence of redds, and 2) the production of progeny the following spring. Radio telemetry (utilizing both fixed stations and mobile tracking, if appropriate) will be used to track movements of older reintroduced fish into spawning tributaries. Additionally, as described in the previous section, ground crews performing presence/absence surveys in habitat patches will be looking for naturally produced progeny. In the latter half of Phase 1, juveniles that were initially translocated to the Clackamas, survived and matured may produce progeny. Any progeny resulting from translocated fish will not initially be physically marked or tagged, unless the decision is made to mark or tag them upon capture during surveys. Whether these fish remain resident in upper habitat patches, or exhibit fluvial or adfluvial life history strategies will be determined through surveys conducted as described above (i.e., through electrofishing, snorkel surveys or other methods that may be utilized in Phase 2).

Genetic samples (small fin clips 2 mm^2 – 1cm^2) will be collected from all bull trout transferred from the Metolius River. Tissue samples collected from any naturally produced juveniles subsequently collected could be used to conduct genetic parentage analysis. This information may be used to gather additional information on reproduction in the Clackamas River including: which individuals produced offspring, if fish transferred at different life history stages differed in spawning success, and if adults originating in specific Metolius tributaries had higher spawning success. Genetic parentage analysis is only successful when genetic samples from all of the potential parents have been collected. Failure to collect fin clips from all bull trout transferred to the Clackamas River (juveniles, sub-adults, adults) means that parentage analysis will only be possible for a small proportion of naturally produced juveniles and only limited information on which individuals successfully spawned will be available.

3.3-d Genetic diversity (B4)

In 2008, staff from the Service's Conservation Genetics Laboratory, Abernathy Fish Technology Center, conducted an assessment of genetic variation in bull trout in the Metolius River Subbasin (i.e., the donor population). Data from this study indicated that bull trout populations in the Metolius River system had relatively high levels of genetic variation compared with other lower Columbia River bull trout populations. The results also indicated there were three related but distinct population clusters of bull trout in the Metolius River; Whitewater River, Jefferson and Candle Creeks, and one made up of Spring, Canyon, and Jack Creeks as well as Heising Spring.

A long-term goal of the Clackamas reintroduction project is to establish a self-sustaining population of bull trout with levels of genetic variation comparable to the founding donor stock

from the Metolius River. In order to monitor our progress towards this goal, a small fin clip will be taken from all bull trout that are translocated to the Clackamas River by either ODFW, the USFS or USFWS (depending on who is responsible for capturing and translocating bull trout) and in the future, from naturally produced individuals collected during monitoring and evaluation efforts. Fin clips from all samples will be stored in 100% non-denatured ethanol at the Conservation Genetics Lab, Abernathy Fish Technology Center, for later analysis.

Individuals representing different life stages and origins (Metolius vs. Clackamas) will be available for genetic analysis. Naturally produced juvenile bull trout collected in spawning areas within the Clackamas River will provide the most effective means of evaluating the spawning population in the Clackamas River and determining if the level of variation observed in the Metolius is represented in naturally produced Clackamas River fish. Genetic variation may fluctuate from year to year due to changes in population size, habitat availability, the number of spawning adults, and other factors. In order to account for year to year fluctuations in genetic variation, initial genetic sampling should be conducted on a yearly basis. After a successful spawning population has been established and baseline genetic information exists, genetic sampling once every bull trout generation should be sufficient. Typically, sample sizes of 50 individuals per local spawning population provide an accurate assessment of genetic variation. While it is undetermined when the 2008 genetics study will be repeated in the Metolius basin, we anticipate that genetic samples will be collected (by either ODFW, USFS, or USFWS) from bull trout that are captured in the Clackamas basin, whether they are translocated individuals or naturally produced progeny. Genetic samples may be obtained during juvenile surveys (described above) or collected from subadults/adults that are captured in the PGE project area or other locations (see SIRP, addendum to the Biological Assessment, Appendix III).

Estimates of genetic variation including allelic richness, observed and expected heterozygosity, and effective population size will be compared to those observed in the Metolius River following the methods outlined in Schwartz et al. (2006) to determine if levels of variation in the Clackamas population are equivalent to those in the donor population and to document changes in the introduced population over time. Estimates of genetic variation in the Clackamas River may also be helpful for determining how long to continue transferring adults from the Metolius River and for monitoring a self-sustaining population(s) in the future for evidence of genetic bottlenecks, inbreeding, estimating effective population size, etc. For fisheries management purposes it will also be important to determine if multiple genetically distinct local spawning populations evolve within the reintroduction area or if a single panmictic spawning population exists. The methods outlined in Waples and Gaggiotti (2006) will be used to determine if multiple spawning populations exist once a self-sustaining population has been established.

3.4 Impacts to Listed Salmon and Steelhead

The Upper Clackamas Subbasin is currently inhabited by listed salmonids including Coho, Chinook, and steelhead. Thus, we are incorporating aspects in this Plan to specifically assess the interactions between bull trout and listed salmonids. In Phase 1, the main questions that will drive our assessment of potential impacts to salmon and steelhead are:

S1. Do adult and subadult bull trout occupy areas in High Vulnerability Zones (HVZs) during smolt migration periods in which they could consume particularly high numbers of juvenile salmon and steelhead?

a. If yes, does listed salmonid production during the freshwater phase decrease relative to historic estimates of freshwater productivity?
b. If the freshwater productivity of listed salmonids decline, could bull trout be responsible for the magnitude of decline observed (i.e., bioenergetics analysis and life cycle modeling)?

We intend to employ the following strategy of sequential questions to determine what, if any, impacts bull trout may be having on listed salmon and steelhead (see also the Stepwise Impact Reduction Plan, SIRP, amended to the BA on May 13, 2011):

1) To address S1, we will **monitor the distribution and movement of subadult and adult bull trout** using PIT and radio-tag technology as described in Section 3.3-a and Appendix II. We will specifically target the movement of adults and subadults to determine whether they are entering HVZs (specifically, North Fork Reservoir or other areas within PGE's hydro project facilities), and if so, assess the timing into and out of these locations. Data from fixed telemetry stations will be uploaded twice per week (and not less than once per week) during peak juvenile anadromous salmonid migration periods (April 15 – June 15 and October 15 – December 15). We will also evaluate if bull trout are staging and foraging in the vicinity of fish bypass facilities, likely using mobile radio tracking and/or visual observations if possible.

2) If we find that bull trout are regularly entering and residing in (i.e., not just passing through) North Fork Reservoir and the PGE hydroproject area (see trigger details in the SIRP), we will work with PGE to address S1.a; i.e., monitor the survival rates of listed salmon and steelhead after the reintroduction of bull trout. PGE is planning to utilize **PIT and radio tags to conduct juvenile survival studies** of salmon and steelhead in reservoirs (see below). PGE's PIT and radio tag studies will examine survival rates of smolts released at the head of North Fork reservoir to the downstream migrant bypass system to Faraday dam, and then to Rivermill dam. Methods to assess changes in survival rate may include modeling, utilization of previous survival estimates for the hydroproject system, and other approaches. In addition PGE will PIT tag some pre-smolts to evaluate reservoir rearing, emigration behavior and over winter survival.

While the above-mentioned studies will help identify survival rates of salmon and steelhead moving through HVZs (specifically North Fork Reservoir and the rest of the PGE hydroproject area), most of these studies will not be initiated until at least 2016. Additionally, there is moderate uncertainty around existing reservoir survival estimates, which will make detecting mortality due to bull trout difficult. In light of these circumstances, we will work with PGE to analyze outmigrant smolt estimates and returning adult counts in an effort to detect changes in freshwater productivity (i.e., the number of smolts produced per adult) that may be due to increased mortality in the freshwater environment. PGE has a dataset that includes outmigrant smolt estimates and

adult returns for approximately the past 30 years, which we will assess and to which we will compare future counts. We will also compare adult returns to those of any appropriate neighboring populations of salmon and steelhead, so that we can determine whether population trends may be occurring over a broader range, possibly as a result of ocean conditions or other factors, instead of conditions solely in the Clackamas.

3) If it is determined that bull trout are present in HPZs (e.g., North Fork Reservoir or other areas of the hydroproject area) and there is an unexplained decrease in freshwater productivity of juvenile salmon and steelhead compared to the historic record, then we will use **modeling approaches** (bioenergetics and/or population matrices) to determine if bull trout could be the cause for changes in survival (addressing S1.b; see trigger details in the SIRP). Some basic bioenergetics modeling has already been performed for the Biological Opinion using Fish Bioenergetics 3.0 (Hanson et al. 1997) to estimate hypothetical scenarios of bull trout consuming maximum numbers of listed salmonids. We will expand upon our initial bioenergetics modeling by estimating how bull trout predation may or may not be linked to the observed change in survival rate by estimating the maximum amount of fish the estimated number of bull trout in North Fork Reservoir must consume to achieve the observed decreases in survival, and then using life cycle models to determine whether the loss of that number of fish could affect populations to the degree observed.

4) If it appears that bull trout survive and reproduce in the Upper Clackamas River, we may replicate the baseline **food web study** that was conducted in 2009 in Phases 2 or 3. The USGS and University of Washington conducted baseline foodweb investigations in the Clackamas River Subbasin to provide a baseline for future foodweb response monitoring once bull trout have been reintroduced and established in the watershed; however, no studies were conducted in Patch 1 (Big Bottom), where adult bull trout may potentially forage on juvenile listed salmon and steelhead. Prior to repeating the food web study, we will want to demonstrate that bull trout have become established in the upper Clackamas Basin (i.e., they are surviving to maturity and reproducing) and have reached some sort of equilibrium within the local food web. While we are unsure of when this may happen, conducting a food web study prematurely may yield misleading results (e.g., either overestimating or underestimating the role of bull trout in the food web).

As mentioned above in item 2, PGE intends to monitor survival of listed salmonids in their hydro facility project area by collecting data at several locations (Figure 10). We anticipate being able to use these PIT tag and radio telemetry fixed stations to track bull trout and assess their potential effects to listed salmonids within the hydro facility project area when they are installed:

<u>Projects Utilizing PIT Tag Antennae</u>

1. **Juvenile Migrant Pipeline:** Starting in 2011, PIT tag antennas will be included at several locations within the migrant pipe, including at the North Fork surface collector and on the pipeline just upstream of the Downstream Migrant Sampling Facility (at the downstream end of the pipeline). In 2012, a study will be initiated to evaluate the timing, injury and survival of migrants passing downstream through the pipeline.

2. **River Mill Dam and Estacada Lake:** A PIT tag detector will be included in the juvenile sampling facility associated with the River Mill surface collector. A study to evaluate timing, injury, and survival of smolts will be initiated in 2013 at this location.
3. **North Fork Ladder:** A PIT tag detector may also be placed in the ladder; whether this will occur is uncertain as is its exact location and whether it would be half- or full-duplex. This is not likely to occur prior to 2015.
4. **Spillway Net Effectiveness Monitoring:** In 2016, a two-year study will be initiated to verify spillway net effectiveness at preventing spillway passage by spring Chinook, coho, and steelhead smolts during spills of up to 4000 cfs at North Fork Dam (may also use radio-tag technology).
5. **Project Smolt Passage Evaluation:** In 2019, PGE will conduct a comprehensive hydroproject-wide study to evaluate smolt passage from North Fork Reservoir to downstream of River Mill Dam (may also use radio-tag technology).

<u>Projects Utilizing Radio Telemetry and Fixed Stations</u>

A. **North Fork Dam & Reservoir:** Fixed radio telemetry receivers will be monitoring the North Fork Reservoir forebay and tailrace for much of the period of 2013-2020. Fixed monitoring stations may also be present at the head of North Fork Reservoir and/or at Promontory Park (mid-reservoir) during the same time period. Additionally, fixed hydroacoustic monitoring of the forebay is likely to occur at some point in the period of 2016-2020. This study will be designed to observe position and trajectories of fish in relation to the surface collectors and turbine intakes.
B. **Juvenile Migrant Pipeline:** Fixed radio telemetry receivers will also be monitoring the River Mill tailrace (at the downstream end of the 7 mile juvenile migrant pipeline) for much of the period of 2013-2020.
C. **North Fork Ladder:** Dropper-style radio telemetry antennas will be placed at the entrance and exit of the North Fork fish ladder (which extends from the Faraday Diversion Dam up to North Fork Dam over 1.7 miles) to monitor passage of tagged adult salmon, steelhead and lamprey through the ladder between 2013-2019.
D. **Upper Faraday Lake and Faraday Lake:** Intermittent radio telemetry monitoring may occur in the North Fork Dam tailrace, at the Faraday Diversion Dam, and at the Faraday Powerhouse during juvenile migrant studies at North Fork Dam. Monitoring at these stations will be limited and likely to occur between 2016-2021.
E. **River Mill Dam and Estacada Lake:** Fixed radio telemetry receivers will be monitoring the River Mill forebay for much of 2013-2020. A fixed monitoring station may also be present at the head of Estacada Lake or at the Faraday Powerhouse tailrace.
F. **Oak Grove Powerhouse:** Fixed radio telemetry receivers will be monitoring the Oak Grove Powerhouse tailrace for much 2013-2020. Since this site lies between the proposed reintroduction areas and North Fork Reservoir, detection of fish here could provide an early alert for radio-tagged fish migrating towards the hydro project.

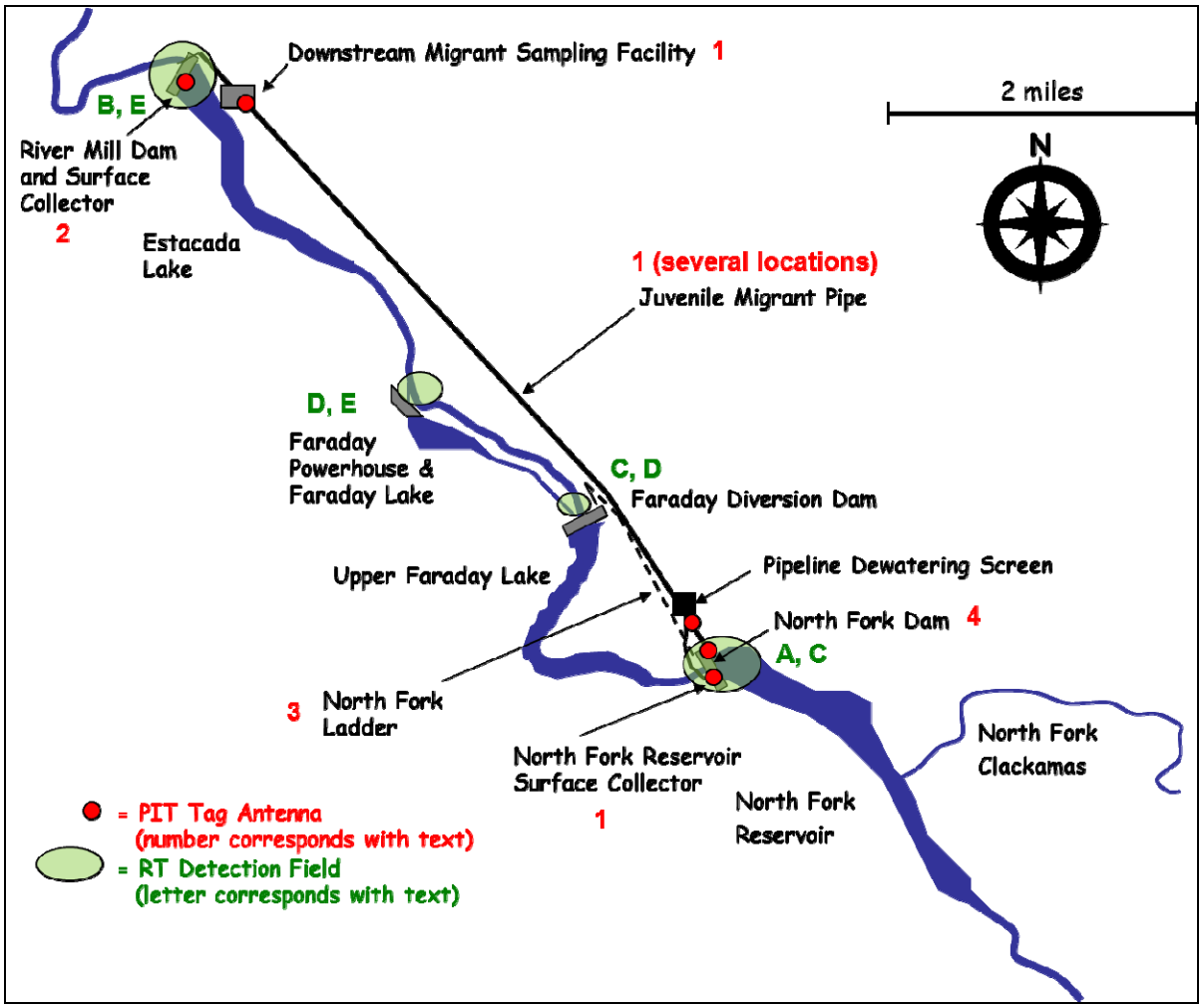

Figure 10. Proposed locations of PGE PIT tag antenna and radio telemetry receivers throughout the PGE Hydroproject area. Red numbers and green letters correspond to the projects listed above.

4. Evaluation Strategy

Evaluation of data gathered through monitoring activities will occur both throughout the year as data is collected and on an annual basis, depending on the type of information gathered (see below). We expect that some very basin questions will be answered during the first two years of the project (e.g., where do bull trout, of each life stage, go after translocation?) that will help inform following years' translocation strategy. Defining measures of success will likely be informed by the first two years of monitoring and related observations, and will require further discussions by the two technical committees (Implementation and Monitoring/Evaluation) and others involved with the monitoring and evaluation component of this project.

Generally, the evaluation of monitoring activities will follow the below steps, but may be revised based on need:

1. Information is gathered from monitoring activities. This can be from focused surveys (e.g., seasonal surveys for juvenile bull trout), or from year-round monitoring (e.g., data uploaded from PIT antennas and telemetry fixed stations).

2. Time sensitive data (i.e., telemetry data collected twice per week during juvenile salmonid migration periods) will be examined immediately to determine if any management action is necessary (see trigger details in the SIRP). If management actions need to occur, they will be executed per the details outlined in the SIRP.

3. After data is gathered, it is entered in a central database. The CRFPO has committed to housing data collection for the project; data will be organized and maintained in a database utilizing GIS technologies so that it can be analyzed as appropriate. Genetic samples will be stored at the Abernathy Fish Technology Center until they are ready to be processed.

4. The agencies collecting the data (i.e., ODFW, USFWS, and USFS) will determine who will analyze the data, depending upon the project component (e.g., distribution of juvenile bull trout, movements of adult bull trout, or measures of freshwater productivity for listed salmonids). Assistance with data analysis may be provided by the USGS, University of Washington, PGE, and others depending on available resources. We anticipate that, outside of time sensitive data, data analysis will occur on a yearly basis.

5. Data analysis for all monitoring components (donor stock, bull trout reintroduction effectiveness, and effects to listed salmonids) will be summarized in a detailed annual report written collaboratively by the lead agencies.

6. The annual report will be submitted to the technical committees for review, and recommendations for the next years' reintroduction strategy will be shaped based on the observations of the current and previous years. A brief schedule and justification for the next years' recommendations will be drafted.

7. The recommendation schedule and justification document for the next years' reintroduction strategy will be provided to the Clackamas Bull Trout Managers Committee for review. If

there is a conflict regarding the direction of the next years' reintroduction strategy, the Managers Committee will review all available information and determine the appropriate course of action.

There are a multitude of questions that could be addressed during the course of the proposed project, but we have chosen to focus on a limited number of questions during the first phase of this project (Appendices 1 and II). Our focus will correspond to the questions outlined in the Monitoring Strategy section above; these high priority questions are consistent with our objectives to learn and share information from this project. The following aspects of the reintroduction will be evaluated on a regular basis to determine if modifications to the implementation strategy are warranted:

1. Donor Population

- Is the donor stock population above the minimum threshold number of spawning adults required to continue donor stock removal? The Implementation subcommittee will ensure that redd counts are being tracked and that estimates of the adult population are above the minimum threshold. The Implementation subcommittee, in addition to providing annual Clackamas project updates to the Deschutes Bull Trout Working Group, will determine if the Donor Stock Advisory Committee needs to review Metolius population data to ensure that the project does not harm the donor population.
- Is the donor population pathogen-free? This question will be answered based on pathogen screening of fry in the spring, and reproductive fluids from mature adults in autumn.
- Do levels of genetic variation in the Metolius spawning tributaries remain relatively unchanged following implementation of the reintroduction program? This analysis will be conducted on a generational basis, likely towards the end of Phase 1 and every 5-7 years after using genetic materials collected and stored at Abernathy.

2. Reintroduced Clackamas Bull Trout Population

- Are adult and subadult bull trout suitable for translocation and reintroduction efforts? This question will be answered by examining distribution of these individuals using radio telemetry and PIT antennas. In determining whether this life stage is appropriate for reintroduction, we will address the following:
  - Do translocated adult and subadult bull trout stay within the Clackamas or leave altogether?
  - What is the seasonal distribution of these life stages? Where is their foraging and overwintering habitat?
  - Based on seasonal distribution, is there evidence of spawning activities?
- Are juvenile bull trout suitable for translocation and reintroduction efforts? This question will be determined by performing ground-based presence/absence surveys and by examining PIT tag data collected at the mouths of tributary streams in the upper Clackamas basin. In determining whether this life stage is appropriate for reintroduction, we will address the following:

  - Do translocated juvenile bull trout stay within the habitat patches they are released in? If not, do they go elsewhere in the upper Clackamas basin or leave the system altogether?
- Beyond survival, which life stages of translocated bull trout successfully contribute naturally produced progeny in the Clackamas? This question will likely be determined by the presence of untagged young bull trout detected during ground-based presence/absence juvenile surveys in upper habitat patches during summer months.
  - Do adults and subadults produce progeny in years 1-3 (and beyond)?
  - Do juveniles mature to produce progeny in years 4-7?
- Can the re-established bull trout population in the Clackamas be self-sustaining given the level of genetic variability in translocated fish? This question will be answered pending analysis of genetic samples taken from translocated individuals; analysis will not occur on a yearly basis, but will likely occur on a generational schedule (every 5-7 years).

3. Impacts to listed salmonids:

- Do older bull trout occur with listed anadromous salmonids in the Clackamas spatially and/or temporally? We will answer this question using radio-telemetry (both fixed stations and mobile tracking), with particular emphasis in tracking bull trout distribution during juvenile salmonid migration periods in the spring and fall.
- If there is overlap in bull trout and listed salmonid distribution in the basin (and in North Fork Reservoir in particular), is there evidence that bull trout decrease the freshwater productivity of listed stocks? While this is a difficult trend to detect, we will examine historic and current migrant and returning adult data to help answer this question. Additionally, we may employ gastric lavage on bull trout collected as a result of actions outlined in the SIRP to gain a better understanding of seasonal diet.
- Given the distribution, overlap with other species, and trends in freshwater productivity, what is the potential contribution of bull trout predation to the mortality of listed anadromous salmonids? We intend to use a combination of bioenergetics modeling and life cycle modeling to answer questions about the level of impact bull trout may have, at the population level, on listed stocks in the Clackamas.

As mentioned above, there are a multitude of questions that could be asked regarding the effectiveness of the Clackamas bull trout reintroduction project. As this project continues and moves into Phases 2 and 3, we may have information sufficient to begin answering questions related to assessing abundance, population trend, and connectivity between habitat patches. Much of the monitoring and evaluation program, including the relevant questions that should be addressed, however, depends upon whether or not bull trout will “stick” in the system and re-establish a population within the ecosystem. Further, it may be years before the re-established population reaches some sort of equilibrium within the food web, so care must be taken when interpreting data for the purpose of implementing management actions.

5. Timeline, Budget, and Responsible Parties

The ODFW and Service will co-lead project implementation and monitoring with assistance from the USFS Mt. Hood National Forest (Figure 11). The Confederated Tribes of the Warm Springs Reservation (CTWSR), Portland General Electric (PGE), and U.S. Geological Survey (USGS) may provide assistance to the project by contributions of equipment and personnel.

A general timeline of events is as follows:

December 2009: Proposed 10(j) Rule and Draft EA submitted for public comment

February 2010: Public comment period closed

September 2010: ODFW Fish and Wildlife Commission Review and modification of Clackamas Subbasin Plan to include bull trout reintroduction
Receive approval from Warm Springs Tribal Council to utilize Metolius fish

Spring 2011: NMFS Section 7 consultation to be concluded
10(j) Final Rule and Final EA/ROD to be published

June 2011: First transfers of juvenile and older life stages of bull trout to the Clackamas will occur

A general timeline for annual monitoring events is as follows:

Early Spring: 150 fry are captured from the Metolius basin for disease testing

Late May/June: Juvenile, subadult, and adult fish are captured from the Metolius River basin, marked and tagged, and transferred to the appropriate habitat patches within the Upper Clackamas Subbasin

July/August: Ground-based surveys (i.e., snorkel surveys and mobile PIT tag tracking; see Section 3.3) to detect juveniles and progeny

Sept./October: Ground-based surveys based on telemetry and PIT detections to assess spawning activities
Annual disease sampling of 60 adults from the Metolius River

Year-round: Mobile radio-tracking and download data from radio receivers and PIT tag antenna arrays 1-2 times per week, depending on season and the level of fish movement

The bulk of project funding will occur through the USFWS, ODFW, and USFS. Sources include both grants and funding programs (e.g., Section 6, Recovery, ServiceFirst, EWEB/PIP, etc.) along with cost sharing for borrowed equipment and staff time (cost sharing is noted in the third category below, where non-cash contributions have been estimated). A general budget for the first two years of Project implementation, monitoring, and evaluation is as follows:

Table 1. General budget for the first two years of the Project.

Personnel	**2011**	**2012**
ODFW Coordinator and seasonals	$113,000	$130,000
Staff Biologist (USFS - 0.5 FTE)	$60,000	
Sub-total	*$173,000*	*$130,000*
Materials/Supplies/Services		
Radio tags, receivers, fixed stations	$60,000	$30,000
PIT tags, readers, antennas	(all equipment)	(radio tags, etc.)
Surgical kit		
Waders/boots		
Vehicle (miles)		
Disease screening	$30,000	
Additional M&E tasks for effectiveness and salmonid monitoring		$50 - $100,000
Sub-total	*$90,000*	*$80 - $130,000*
Cost Share		
Equipment Donation and Personnel (ODFW)	$75,000	
Personnel (USFWS/CRFPO – 0.3 FTE)	$40,500	$40,500
Personnel (USFWS/OFWO – 0.9 FTE)	109,500	$109,500
Sub-total	*$225,000*	*$150,000*
Total	**$488,000**	**$360 - $410,000**

Additionally, genetic samples will be analyzed every 5-7 years. For 250 fish, it currently costs about $18,000 to run all the fish, analyze the data, and write a report. For 500 fish the cost would go up to about $28,000 and for 750 fish the cost goes up to about $36,000 (P. DeHaan, USFWS, pers. comm. 2011).

The Oregon Department of Fish and Wildlife Clackamas Project Coordinator will facilitate much of the field work, beginning in the spring and early summer of 2011 (Figure 11). The USFS has agreed to support ODFW field activities when possible, and the USFWS will also participate in field and analytical activities (Figure 11). We anticipate that the field schedule for 2012 will be similar to 2011, pending information gathered from the first year's monitoring and evaluation activities.

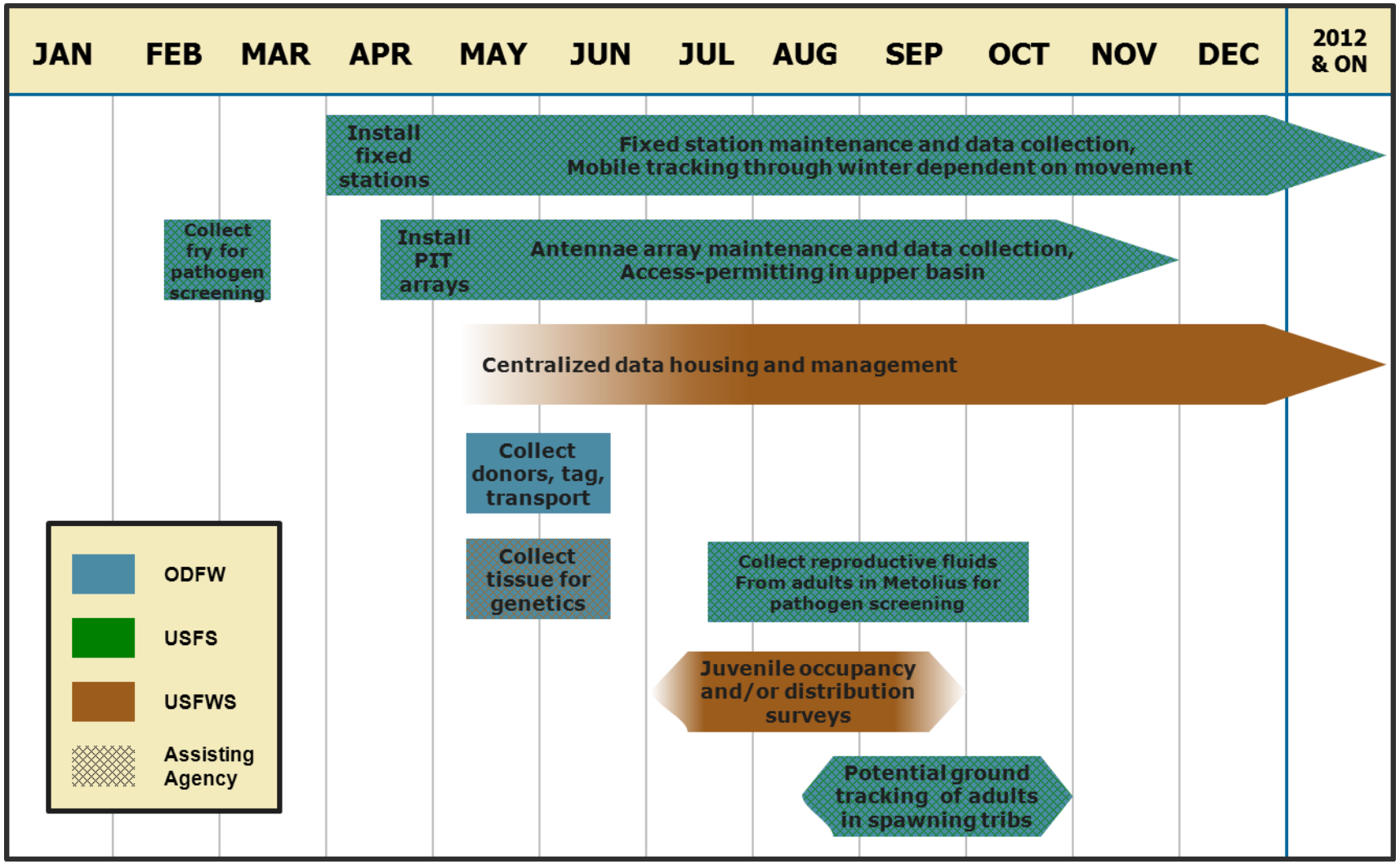

Figure 11. Roles of agencies in collecting fish and performing monitoring activities in 2011.

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7. Appendices

I. Clackamas Bull Trout Reintroduction IM&E Prioritized Questions

II. Summary of Design and Implementation Needs for FY 2011

III. Stepwise Impact Reduction Plan (SIRP), amendment to the Biological Assessment, May 13, 2011

Appendix I. Clackamas Bull Trout Reintroduction IM&E Prioritized Questions

There are three main questions that we will try to assess during the three phases of the reintroduction project:

1) Can the Metolius basin bull trout population continually be an appropriate donor stock for the Clackamas reintroduction;
2) Can a self-sustaining population of Clackamas bull trout be re-established by translocating fish from the Metolius basin; and
3) Does the reintroduction of bull trout have a significant negative impact on the recovery of listed salmonids also in the basin?

	Donor Stock Status (Implementation)	Clackamas Bull Trout Reintroduction Effectiveness (M&E)	Impacts to Listed Salmonids (M&E)
Phase 1: Years 1-7	D1. Does the donor stock population have the minimum threshold number of spawning adults required to continue donor stock removal? D2. Is the donor population disease-free?	B1. Do translocated adult and subadult bull trout remain in the upper Clackamas Basin (above River Mill Dam)? a. If yes, what is their seasonal distribution? b. If yes, is there evidence of spawning activity? If no, does changing the release timing/location provide a different result? B2. Do juveniles remain in the habitat patches they are outplanted to in the short-term or do they move relatively quickly out or into other habitat patches? a. If they stay, how are juveniles distributed within habitat patches? B3. Which translocated life stages are successful in contributing naturally produced progeny in the Clackamas River? a. Do adults and subadults produce progeny in years 1-3 (and beyond)? b. Do translocated juveniles mature to produce progeny in years 4-7? B4. Is the level of genetic variation in the donor population adequately represented by translocated fish (years 4-7)?	S1. Do adult and subadult bull trout occupy High Vulnerability Zones (HVZs) during smolt migration periods in which they could consume particularly high numbers of juvenile salmon and steelhead? a. If yes, does listed salmonid production during the freshwater phase decrease relative to historic estimates of freshwater productivity? b. If the freshwater productivity of listed salmonids decline, could bull trout be responsible for the magnitude of decline observed (i.e., bioenergetics analysis and life cycle modeling)?

	Donor Stock Status (Implementation)	Clackamas Bull Trout Reintroduction Effectiveness (M&E)	Impacts to Listed Salmonids (M&E)
Phase 2: Years 8-15	D3. Does the donor stock population have the minimum threshold number of spawning adults required to continue donor stock removal? D4. Is the donor population disease-free? D5. Are there any indications of deleterious impacts (genetic fitness or population abundance) to the donor population from removing individuals for translocation?	B5. What is the estimated population size of the reintroduced population? B6. Is the level of genetic variation in the donor population adequately represented by the Clackamas population? B7. What habitats do naturally produced and translocated bull trout utilize for spawning and rearing? B8. What life history strategies do naturally produced fish in the Clackamas exhibit? B9. How has the food web changed as a result of reintroducing bull trout into the Clackamas River basin?	S2. Do adult and subadult bull trout occupy areas in the PGE hydroproject during smolt migration periods in which they could consume particularly high numbers of juvenile salmon and steelhead? S3. What is the estimated level of bull trout predation on juvenile salmon and steelhead? S4. Are there potential indirect food-web effects of bull trout on salmon and steelhead?
Phase 3: Years 16 - 21	D6. Does the donor stock population have the minimum threshold number of spawning adults required to continue donor stock removal? D7. Is the donor population disease-free? D8. Were there long-term detrimental impacts (genetic fitness or population abundance) to the donor population from removing individuals for translocation?	B10. Is the level of genetic variation in the donor population adequately represented by the Clackamas population? B11. What is the effective population size and trend? B12. What is the structure of the Clackamas bull trout population?	S5. Do adult and subadult bull trout occupy areas in the PGE hydroproject during smolt migration periods in which they could consume particularly high numbers of juvenile salmon and steelhead? S6. What is the estimated level of bull trout predation on juvenile salmon and steelhead? S7. Are there potential indirect food-web effects of bull trout on salmon and steelhead?

Appendix II. Clackamas Bull Trout Reintroduction Summary of Design and Implementation Needs for FY 2011

PROJECT PHASE 1: Years 2011 – 2017

Project Component	Study Question Addressed	Time Frame
Operations and Logistics		
Monitoring of the donor population - Redd surveys throughout Metolius subbasin - Creel surveys in Lake Billy Chinook - Outmigrant screw-trap in Metolius River at Monty - Juvenile BT density monitoring at index reaches in spawning streams	D1	Ongoing annually, will continue throughout the life of the project
Disease screening for IHNV - Performed by the ODFW Fish Health Services labs in Madras or Corvallis - Will require 60 ripe bull trout adult (nonlethal) and 150 fry (lethal)	D2	Every year starting in 2009; adults – fall prior to translocation, fry – spring of translocation
Adult and subadult (>250 mm) collection from the Metolius basin (see also tagging, below) - Collected from Metolius arm of Lake Billy Chinook - Angling, collection at Round Butte Dam		May and June, starting 2011
Juvenile (<250 mm) collection from the Metolius basin (see also tagging, below) - Collected from the mainstem Metolius and tribs - Snorkel herding, seining, electrofishing		May and June, starting 2011
Hold fish prior to transport to the Clackamas basin - Adults and subadults: holding tanks at Round Butte Fish Isolation Facility - Juveniles: holding tanks at Round Butte Fish Isolation Facility		May and June, starting 2011
Transport fish to the Clackamas basin		May and June, starting 2011
Release fish in Clackamas basin - Adults and subadults: Big Bottom - Juveniles: Big Bottom and upper basin patches (1-6) rotationally, 500 in each of two patches per year		May and June, starting 2011 2011-2012: Pinhead and Cub/Berry 2013-2014: Rhodo and Upper Clack 2015-2016: Hunter and Big Bottom

Project Component	Study Question Addressed	Time Frame
Monitoring and Evaluation		
Half-duplex PIT tag all fish collected from the Metolius - Tag upon catch; use 23 mm tags for fish > 120 mm, use 12 mm tags for fish < 120 mm - Dorsal sinus for fish > 300 mm; body cavity for < 300 mm	B1.a-b, B2.a, S1	May and June, starting 2011 through all translocation years
Radio-tag all adults and subadults collected from the Metolius basin - Tag upon catch from Lake Billy Chinook - Maximize battery duration, using tag size dependent on fish size (2+ years battery life)	B1.a-b, S1	May and June, starting 2011 through 2012
Install fixed-station radio antennas in the Clackamas basin to track movements of adults and subadults (listed in order of priority): - Below River Mill Dam (1) - Head of North Fork Reservoir (2) - North Fork Reservoir collector (3) - Collawash confluence (4) - On Clack at Last Creek (5)	B1.a-b, S1	Install spring 2011, upload data every 7-10 days April – Dec. starting 2011 through life of batteries (may be less in winter depending on movement). During peak migration times (Apr. 15 – June 15 and Oct. 15 – Dec. 15) data will be uploaded 2 x/wk, with a minimum of 1 x/wk.
Install half-duplex PIT tag arrays in the Clackamas basin to track all translocated fish: - At mouths of patches 2-6 tributaries (Fork of Last/Pinhead, Fork at Upper Clack/Cub-Berry, Hunter, Rhodo) and in the downstream bypass of the hydrofacilities	B1.a-b, B2.a, S1	Install spring 2011, upload data every 7-10 days April – Dec. starting 2011 through life of batteries (may be less in winter depending on movement).
Look for evidence of spawning: - Assess radio and PIT tag data that may indicate fish moving to spawning habitat - Mobile tracking: ground and/or aerial tracking during spawning season (opportunistic observation of presence of redds or actively spawning fish)	B1.a-b	Mobile radio tracking: in conjunction with antennae maintenance, dependent on fish movement (aerial if necessary) Mid Aug – Oct, starting Fall 2011 – through end of Phase 1
Ground-based surveys to detect presence (survival) of juveniles and naturally produced progeny (electrofishing and/or night snorkeling and mobile PIT tag tracking) - GRTS (21 surveys of 50 m reaches per patch per RMEG guidelines) or census the two patches that juveniles were released in each year. - Based on locations of adults, may survey additional patches to survey for progeny	B2.a, B3.a-b	Summer of each year that juveniles are reintroduced, starting 2011 through end of Phase 1
Collect tissue samples for genetic analysis: - Fin clip all fish translocated from the Metolius - Collect fin clips from all unmarked BT found (during electrofishing or night snorkeling surveys) in the Clackamas to assess parentage (and determine which translocated life stage successfully reproduced depending on observed/assumed spawning behavior)	B3.a-b, B4	May – June, starting in 2011 with collection of fish to be translocated and during summer juvenile surveys in years 2 – 7 of Phase 1

Appendix III. Stepwise Impact Reduction Plan

May 13, 2011

The U.S. Fish and Wildlife Service (FWS) developed this Stepwise Impact Reduction Plan (SIRP) in collaboration with the National Marine Fisheries Service (NMFS), as part of our Section 7 consultation process on the reintroduction of bull trout (*Salvelinus confluentus*) to the Clackamas River. The SIRP was submitted to NMFS in May 2011 as an amendment to the FWS' December 10, 2010, biological assessment (BA), and thus as part of the Clackamas bull trout reintroduction project.

The purpose of the SIRP is to outline a sequence of management actions that, if necessary, will be taken to minimize impacts to federally listed salmon (*Oncorhynchus spp.*) and steelhead (*O. mykiss*) from the reintroduction of bull trout in the Clackamas River, and the thresholds that would trigger initiation of these actions. Management actions implemented under the SIRP, and the frequency of those actions, will be driven by the population status of the listed Clackamas anadromous salmonid populations and information gathered through the reintroduction project's monitoring and evaluation program, jointly implemented by the FWS, Oregon Department of Fish and Wildlife (ODFW), and the U.S. Forest Service, Mt. Hood National Forest (USFS).

The SIRP is consistent with the adaptive management approach for the project as described in our BA. For the purposes of the SIRP, impacts (whether they can be directly monitored or not) are generally defined as: 1) direct predation on eggs, fry and juveniles of listed anadromous salmonids by bull trout; 2) competition for food and/or shelter between listed anadromous salmonids and bull trout, which could reduce juvenile salmon and steelhead fitness; and 3) predator avoidance behaviors which could reduce passage efficiencies for juvenile salmon and steelhead migrating through Portland General Electric's (PGE) Clackamas River Hydroelectric Project.

While FWS and NMFS believe the SIRP will provide much of the guidance necessary to address potential impacts to listed salmon and steelhead from the reintroduction project, we acknowledge our inability to predict all likely impact scenarios and appropriate management responses. As a result, we anticipate the SIRP will be modified as necessary, consistent with the overall adaptive management strategy of the project, in consultation and coordination with NMFS and ODFW, and based on both the monitoring and evaluation program and the conservation status of threatened salmon and steelhead populations in the Clackamas River.

<u>Sequence of Management Actions:</u>

Actions one and two (Table 1 below) represent triggers and associated management actions for bull trout relocation or removal based on geographic locations of detections within defined areas of high vulnerability for juvenile anadromous salmonids due to bull trout predation or predator avoidance behavior. These areas of high vulnerability exist due to the presence of PGE's Clackamas River Hydroelectric Project, a system of dams, reservoirs, and fish bypass facilities which concentrate juvenile anadromous salmonids during certain times of the year. Actions one and two can be implemented at any time by ODFW, FWS, USFS or PGE personnel. Additional detail, such as guidance on agency coordination and notification prior to relocating or removing

bull trout, agency personnel authorized to carry out actions one and two, locations to release bull trout that are relocated, and a disposition plan for bull trout that are removed from the Clackamas River, will be developed prior to moving bull trout to the Clackamas River in 2011. This additional information will be added to the SIRP (which will also be appended to the Project's Implementation, Monitoring and Evaluation Plan) and shared with all agencies and partners involved in the implementation and monitoring of the reintroduction project.

In the description of actions three through six, NMFS has established specific critical thresholds relating to the population abundance and productivity of Clackamas populations of coho (*O. kisutch*), spring Chinook (*O. tshawytscha*) and steelhead. We acknowledge that the biological opinion (BO) from NMFS will assume that actions will be taken in accordance with this SIRP, including Table 1 below, if the thresholds (i.e., triggers) are reached. We also acknowledge the need for future coordination between the Service, NMFS, ODFW, and where applicable, other project partners, on implementation of the SIRP actions.

Table 1: Bull Trout and Anadromous Salmonid Thresholds Requiring Management Action

Action #	Bull Trout Threshold	Anadromous Salmonid Thresholds	Management Action
1	Subadult or adult bull trout (> 250mm or 10 inches) at any time are found staging (minimum 3 days) in a high vulnerability zone (HVZs) (as opposed to moving through the hydro project area). HVZs include any fish facility of the Clackamas Hydro Project (traps, pipeline, surface collector, dewatering facility, North Fork forebay from the face of the dam to the log-booms (approximately 1000 upstream of the dam), and the River Mill Dam forebay within 1,000 ft of River Mill Dam.	No anadromous salmonid threshold is involved with this action.	**Relocation:** Bull trout at any time may be captured and relocated from HVZs to approved locations (TBD) upstream of N. Fork Reservoir. Efforts to track the presence of bull trout in HVZs, and associated relocation efforts if thresholds are exceeded, will be concentrated during critical time periods for anadromous smolt migration (April 15 to June 15 and October 15 to December 15) and opportunistic outside of these timeframes.
2	Any tagged subadult or adult bull trout, as described above, that was previously relocated from a HVZ area during a peak juvenile anadromous salmonid migration time period (April 15 to June 15, and October 15 to December 15) reappears in an HVZ area within seven days or three times during a single peak migration period.	No anadromous salmonid threshold is involved with this action. However, if all three Clackamas populations (coho, spring Chinook and steelhead) exceed the recovery target for abundance threshold (VSP scenario) for 3 consecutive years (see Table 2) then removal of bull trout would not be warranted and would not occur under any scenario and from any location in the Clackamas River.	**Removal:** Individual bull trout will be removed from the population per the disposition plan (TBD).
3	15 or more subadult or adult bull trout are removed from the population as a result of management action number two above.	Adult returns for coho, spring Chinook or steelhead in the Clackamas River drop below the minimum abundance threshold (MAT) established by LCRTRT (see Table 2) (a single annual occurrence for any population).	**Additional Study:** If the bull trout threshold **and** the MAT are reached (for one or more populations annually), initiate a detailed bioenergetics and life cycle modeling analysis to evaluate the potential contribution of bull trout to the observed population trends of listed anadromous salmonids in the Clackamas. This exercise will include an evaluation of other lower Columbia River anadromous salmonid populations and associated hatchery programs to determine the degree to which ocean conditions and other factors may be responsible for current population trends in the Clackamas River.

4	Same as #3 above. And, bioenergetics analysis and life cycle modeling indicate that bull trout are likely contributing to the observed population-level trends for anadromous salmonids in the Clackamas River.	For one or more populations, the number of juveniles exiting past North Fork Dam drops below the anadromous salmonid critical threshold (see Table 2) and/or For one or more populations, the coho, Chinook or steelhead counts at North Fork Dam drop below the smolts per adult critical threshold (see Table 2).	**Suspension of Subadult and Adult Fish Transfers:** If the bull trout threshold **and** either the anadromous salmonid critical threshold or smolts per adult critical threshold are reached for one or more populations, the transfer of subadult and adult bull trout to the Clackamas will be suspended. Transfers of these life stages may resume in subsequent years if the above thresholds are not triggered for both bull trout and listed anadromous salmonids. If these thresholds are exceeded for two years in a row, a replication and possible expansion of the 2009-2010 baseline foodweb study (Lowery & Beauchamp 2010) may be implemented.
5	Same as #3 above. And, bioenergetics analysis, life cycle modeling, and possibly food web studies indicate that bull trout are likely contributing to the observed population-level trends for anadromous salmonids in the Clackamas River.	Same as #4 above, but either threshold is reached twice for a single population or three times for any combination of populations in four years. (see Table 2)	**Reduce Bull Trout Abundance & Suspend all Fish Transfers:** If the bull trout threshold **and** either the anadromous salmonid critical threshold or smolts per adult critical thresholds for this action level are reached: 1) suspend transfers of all bull trout to the Clackamas River; and, 2) consult and coordinate with ODFW to allow a limited harvest fishery on bull trout in the Clackamas River to reduce subadult and adult abundance. The number of bull trout targeted for harvest will be determined at a later date in coordination with ODFW and NMFS.
6	Bioenergetics analysis, life cycle modeling, food web studies and direct evidence link bull trout to population level impacts to anadromous salmonids in the Clackamas R. at a level that would prevent recovery of these populations.	Same as #4 and 5 above, but either threshold is reached three times for a single population or five times for any combination of populations in five years. (see Table 2)	**Removal of Bull Trout from the Clackamas:** Active pursuit and removal of all life stages (i.e. reversal of action). This action would require that NMFS, ODFW and FWS complete any required administrative process or rule-making necessary to make the change being proposed.

Rationale for Population Indicator Levels: The rationale and Table 2 below were developed by NMFS with data from ODFW, PGE, and the Lower Columbia River Conservation and Recovery Plan for Oregon. NMFS, FWS, and ODFW acknowledge that these numbers may be modified in the future as new data become available and recovery planning progresses. If and when these numbers change, the SIRP will be modified accordingly in coordination with NMFS and ODFW, with input from other project partners). The indicator levels given below in Table 2, focus on two primary concerns:

1. Freshwater survival of anadromous salmonids relative to pre-bull trout introduction: smolts per adult. This threshold, smolts produced per adult, is intended to detect any downturn in freshwater productivity, possibly related to bull trout introduction. We analyzed the smolts produced per adult for each species (coho, Chinook, steelhead) over the last 30 years and established the lower quintile (lowest 20%) of the distribution as a threshold of concern. For example, based on the record for coho salmon, this is reached when smolt outmigration falls below 38.1 smolts per adult. For purposes of this SIRP document, this is referred to as the **smolts per adult critical threshold.**

2. Minimum abundance levels for population persistence: number of smolts outmigrating.
We established 500 adults as an important inflection point in population demographics – it is well below the minimum abundance thresholds and far below the ESA recovery targets for the Clackamas populations of coho, Chinook and steelhead. We then estimated the number of smolts necessary to produce 500 adults given relatively poor conditions. Recognizing that the smolt-to-adult ratio (SAR) can vary considerably depending on the species and the year, we used the lower quintile (lowest 20%) of SARs to set the **anadromous salmonid critical threshold** in order to ensure that if the numbers fall to this crisis level, the necessary actions can be initiated to protect the anadromous population regardless of the cause.

Table 2: Threshold Levels Referred to in Table 1

Adult counts	Coho	Spring Chinook	Steelhead
Minimum Abundance Threshold[1]: **Anadromous salmonid warning indicator**: adults counted at North Fork Dam, three year average for coho, four year average for steelhead and Chinook:	2160	780	600
Recovery Target for adult abundance (VSP Scenario)	Very Low Risk[2] 11,232[2]	Very Low Risk [6] 2314[3]	Low Risk[6] 10,671[4]
Juvenile Counts			
A. **Anadromous salmonid critical threshold:** # of coho, steelhead or spring Chinook juveniles leaving the North Fork Reservoir in any year is at or below the lowest quintile of smolts from the thirty year record.	54,431	6,237	20,374
Smolts per adult critical threshold (based on lowest quintile of smolt to adult survival from the thirty year record)	38.1	3.1 (does not account for smolts spilled)	10.2

[1] LCR Conservation and Recovery Plan for Oregon… August 6, 2010 Table 4-4
[2] LCR Conservation and Recovery Plan for Oregon… August 6, 2010 Figure 6-1
[3] UWR Conservation and Recovery Plan for Oregon… October 2010 Table 6-11

Table 3: Additional Data (as of May, 2010) For Reference on Clackamas Anadromous Populations.

Adult counts	Coho	Spring Chinook	Steelhead
Average of lowest 3 Adult Counts	140	853	420
Minimum Abundance Threshold[4]: Anadromous salmonid warning indicator (adults counted at North Fork Dam: three year average for coho, four year average for steelhead and spring Chinook)):	2160	780	600
Recent Average Adult Count (Source: PGE 2010)	1935	2,381	2346
"Maintain into future" abundance[5]	8630[2]	1896[2]	4692[3]
Current Clackamas population status (risk of extinction)	Moderate	Moderate	Low to Moderate
Current species status (risk of extinction) [6]	Very High	Very High	High
Recovery Target for abundance: (VSP Scenario)	Very Low Risk[7] 11,232[2]	Very Low Risk [6] 2314[8]	Low Risk[6] 10,671[4]
Historic abundance	52,565[2]	27,000[3]	21000[4]
Smolts per Adult (Average)	72.10	8.33	18.39
Smolts per Adult (20%)	38.1	3.1	10.2
Smolts per Adult (Low 3)	26.61	1.00	8.51
Juvenile Counts (based on current methods used by PGE to adjust to account for spill, subject to revision by management committee as appropriate)			
Average Smolt Count	87,523	16,588	32,590
Average Smolt Count (20%)	54,431	6,237	20,374
Average Smolt Count (Low 3)	20,355	1995	8,271
Average Smolt to Adult Survival[9]	3.1%	27.1%	5.7%
SAR (20%)	0.91%	8.34%	2.79%
SAR (Low 3)	0.26%	5.6%	2.0%
Smolts to produce 500 Adults (based on lowest 3 SAR years)	194,611	8,929	25,176
Anadromous salmonid population critical threshold: # of coho, steelhead or spring Chinook juveniles leaving the North Fork Reservoir in any year is at or below the lowest quintile of smolts from the thirty year record,	54,431	6,237	20,374
Smolts per adult critical threshold (based on lowest quintile of smolt to adult survival from the thirty year record)	54,945	5,995	17,921

[4] LCR Conservation and Recovery Plan for Oregon… August 6, 2010 Table 4-4
[5] LCR Conservation and Recovery Plan for Oregon… August 6, 2010 (§ 6.2.2 Population-Specific Scenarios) defines "maintain into future" as doing the minimum amount necessary to achieve only the 20 percent increase in abundance to meet unknown future threats and maintain the current risk class
[6] Ford et al 2010
[7] LCR Conservation and Recovery Plan for Oregon… August 6, 2010 Figure 6-1
[8] UWR Conservation and Recovery Plan for Oregon… October 2010 Table 6-11
[9] SAR for Coho assumed 3 year life cycle, for Steelhead and Chinook salmon a 50:50 split for 4 and 5 year old returning adults.