

STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit for bull trout. The combination of core habitat (*i.e.*, habitat that could supply all the necessary elements for the long-term security of bull trout, including for both spawning and rearing, foraging, migrating, and overwintering) and a core population (*i.e.*, bull trout inhabiting a core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit. Within a core area, many local populations may exist.

For purposes of recovery, the Upper Columbia Recovery Unit has three core areas, including the Wenatchee, Entiat, and Methow Rivers. Although we know bull trout in the Upper Columbia migrate to the Columbia River and back, we do not clearly understand the extent of their use and distribution in the Columbia River mainstem. Factors considered when identifying core areas included: the extent of historic and current migratory connectivity, existence natural barriers, survey and movement data, and genetic information where available. Except where supported by biological or geographic evidence, core areas are considered to be distinct, and their boundaries do not overlap. Additional genetic information within the Upper Columbia Recovery Unit may help refine the current classification.

Within each core area, many local populations may exist. A local population is defined as a group of bull trout that spawn within a particular stream or portion of a stream system. A local population is assumed to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Based on survey data and professional judgement, the Upper Columbia Recovery Team identified 16 local populations in the Wenatchee (6), Entiat (2) and Methow (8) core areas.

Recovery Goals and Objectives

The goal of the bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed across the native range of the species, so that it can be delisted. To achieve this goal, the following objectives have been identified for bull trout in the Upper Columbia Recovery Unit:

- ▶ Maintain the current distribution of bull trout and restore distribution in previously occupied areas within the Upper Columbia Recovery Unit.
- ▶ Maintain stable or increasing trends in abundance of bull trout.
- ▶ Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
- ▶ Conserve genetic diversity and provide opportunities for genetic exchange.

Rieman and McIntyre (1993) and Rieman and Allendorf (2001) evaluated the bull trout population numbers and habitat thresholds necessary for long-term viability of the species. They identified four elements, and the characteristics of those elements, to consider when evaluating the viability of bull trout populations. These four elements are: 1) number of local populations; 2) adult abundance (defined as the number of spawning fish present in a core area in a given year); 3) productivity, or the reproductive rate of the population (as measured by population trend and variability); and 4) connectivity (as represented by the migratory life history form and functional habitat). For each element, the Upper Columbia Recovery Unit Team classified bull trout into relative risk categories based on the best available data and the professional judgment of the team.

The Upper Columbia Recovery Unit Team also evaluated each element under a potential recovered condition to produce recovery criteria. Evaluation of

these elements under a recovered condition assumed that actions identified within this chapter had been implemented. Recovery criteria for the Upper Columbia Recovery Unit reflect: 1) the stated objectives for the recovery unit, 2) evaluation of each population element in both current and recovered conditions, and 3) consideration of current and recovered habitat characteristics within the recovery unit. Recovery criteria will probably be revised in the future as more detailed information on bull trout population dynamics becomes available. Given the limited information on bull trout, both the level of adult abundance and the number of local populations needed to lessen the risk of extinction should be viewed as a best estimate.

In this approach to developing recovery criteria, the status of populations in some core areas may fall short of ideals described by conservation biology theory. Some core areas may be limited by natural attributes or by patch size, and may always remain at a relatively high risk of extinction. Because of limited data within the Upper Columbia Recovery Unit, the recovery unit team relied heavily on the professional judgment of its members.

Local Populations

Metapopulation theory is important to consider in bull trout recovery. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (see Chapter 1). Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events. In part, distribution of local populations in such a manner is an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than 5 local populations are at increased risk, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk.

Currently, local populations of migratory bull trout in the Wenatchee Core Area include: Chiwaukum Creek, Chiwawa River (including Chikamin, Rock, Phelps, Alpine, Buck, and James Creeks), White River (including Canyon and Panther Creeks), Little Wenatchee (below the falls), Peshastin Creek (including

Ingalls Creek), and Nason Creek (including Mill Creek). Migratory local populations in the Entiat Core Area include the mainstem Entiat and Mad Rivers. The Methow Core Area has migratory bull trout local populations in Gold Creek (including Crater Creek), Twisp River (including North and Reynolds Creeks and mainstem, East and West Fork Buttermilk Creeks), Wolf Creek, Chewuch River, Goat Creek, Early Winters Creek (including Cedar and Huckleberry Creeks), Lost River (including Cougar Lake, First Hidden Lake, Middle Hidden Lake and Monument Creek), and Upper Methow River. Bull trout in the Wenatchee and Methow Core Areas are considered at an intermediate risk, while bull trout in the Entiat Core Area are at an increased risk. Resident bull trout are known to occur in each core area within the recovery unit. However, an accurate description of their current distribution is unknown, and the identification of resident local populations is considered a research need.

Adult Abundance

The recovered abundance levels in the Upper Columbia Recovery Unit were determined by considering theoretical estimates of effective population size, historical census information, and the professional judgment of recovery team members. In general, effective population size is a theoretical concept that allows us to predict potential future losses of genetic variation within a population due to small population sizes and genetic drift (see Chapter 1). For the purpose of recovery planning, effective population size is the number of adult bull trout that successfully spawn annually. Based on standardized theoretical equations (Crow and Kimura 1970), guidelines have been established for maintaining minimum effective population sizes for conservation purposes. Effective population sizes of greater than 50 adults are necessary to prevent inbreeding depression and a potential decrease in viability or reproductive fitness of a population (Franklin 1980). To minimize the loss of genetic variation due to genetic drift and to maintain constant genetic variance within a population, an effective population size of at least 500 is recommended (Franklin 1980; Soule 1980; Lande 1988). Effective population sizes required to maintain long-term genetic variation that can serve as a reservoir for future adaptations in response to natural selection and changing environmental conditions are discussed in Chapter 1 of the recovery plan.

For bull trout, Rieman and Allendorf (2001) estimated that a minimum number of 50 to 100 spawners per year is needed to minimize potential inbreeding effects within local populations. In addition, a population size of between 500 and 1,000 adults in a core area is needed to minimize the deleterious effects of genetic variation from drift.

For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations containing fewer than 100 spawning adults per year were classified as at risk from inbreeding depression. Bull trout core areas containing fewer than 1,000 spawning adults per year were classified as at risk of genetic drift.

Overall, bull trout in the Wenatchee, Entiat, and Methow core areas persist at low abundance. The strongest population in the Wenatchee Core Area is the Chiwawa River. Since 1999, the Chiwawa River has ranged between 246 and 462 redds annually. Conservative estimates (2 fish per redds) would result in an estimate of 492 to 924 spawning adults in the Chiwawa local population. Based on the aforementioned guidance, the Chiwawa River local population is not at risk of inbreeding depression. All other local populations in the Wenatchee Core Area persist at low abundance levels, and are considered at risk of inbreeding depression. Accurate abundance estimates for the Wenatchee Core Area are not available. However, results from the 2001 redd surveys in the Wenatchee Core Area indicate that the annual spawning population is probably less than 1,000 individuals, and should be considered at risk of genetic drift. Both local populations in the mainstem Entiat and Mad rivers persist at low abundance levels (less than 100 individuals), and are considered at risk of inbreeding depression. The low abundance in the Entiat Core Area places it at risk of genetic drift. Seven of the local populations in the Methow Core Area are mostly under 100 adults annually and are at risk of inbreeding depression. The most recent 4-year average for adult abundance (174) in the Twisp River indicates that this local population may not be at risk of inbreeding depression. However, the high variability in redd counts in the Twisp River is a source of concern, and the genetic risk for this local population should continue to be monitored. Based on available

information, adult spawning abundance in the Methow Core Area is probably less than 1,000 adults and therefore is at risk of the deleterious effects of genetic drift.

Productivity

A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*, productivity over the entire life cycle) that indicate a population is consistently failing to replace itself also indicate an increased risk of extinction. Therefore, the reproductive rate should indicate that the population is replacing itself, or growing.

Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population that is below recovered abundance levels, but that is moving toward recovery, would be expected to exhibit an increasing trend in the indicator.

The population growth rate is an indicator of probability of extinction. This probability cannot be measured directly, but it can be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient for the population to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time.

In the Upper Columbia Recovery Unit, bull trout were classified as having an increased risk due to either the short duration of population census information, or the incomplete record of the redd count surveys within each core area.

Connectivity

The presence of the migratory life history form within the Upper Columbia Recovery Unit was used as an indicator of the functional connectivity of the recovery unit. If the migratory life form was absent, or if the migratory form was present but local populations lacked connectivity, the core area was considered to be at increased risk. If the migratory life form was persisting in at least some local populations, with partial ability to connect with other local populations, the core area was judged to be at intermediate risk. If the migratory life form was present in all or nearly all local populations, and had the ability to connect with other local populations, the core area was considered to be at diminished risk.

Within the Wenatchee and Entiat Core Areas, the migratory life history form is predominant within the existing local populations, and both areas were considered at a diminished risk. While localized habitat problems currently exist that may impede connectivity, there are no large scale man-made migration barriers within either system. Conversely, habitat degradation within the Methow Core Area has fragmented bull trout populations within the basin. Reduction in habitat quality resulting from irrigation water withdrawals, diversion dams, grazing, and passage barriers associated with culverts have collectively contributed to the decline of bull trout in the basin. Bull trout in the Methow Core Area were considered to be at an increased risk.

Recovery Criteria

Recovery criteria for bull trout in the Upper Columbia Recovery Unit are as follows:

1. **Distribution criteria will be met when bull trout are distributed among at least 16 local populations in the Upper Columbia Recovery Unit.** The 16 identified local populations are currently distributed within the Wenatchee (6), Entiat (2) and Methow (8) core areas and are comprised of the migratory life history form. For recovery to occur, the distribution of these migratory local populations should be maintained while abundance is increased. The recovered distribution places the Wenatchee and Methow Core Areas at an intermediate risk from stochastic events. The Entiat Core Area, under a recovered condition, would remain at an increased risk from stochastic events. The Upper Columbia Recovery Unit Team recognizes that natural habitat features within the Wenatchee, Entiat, and Methow Rivers may limit the expansion of bull trout distribution. Designation of local populations is based on survey data and the professional judgement of Upper Columbia Recovery Unit Team members. Further genetic studies are needed in order to more accurately delineate local populations, and quantify spawning site fidelity and straying rates. The complete distribution of resident local populations in the recovery unit is unknown. The Upper Columbia Recovery Unit Team recommends that further studies be conducted in the Wenatchee, Entiat, and Methow Core Areas to elucidate the current and recovered distribution of resident bull trout in the recovery unit. Geographic distribution of resident local populations should be identified within 3 years, and actions needed to implement reintroduction efforts should be incorporated into review of the Upper Columbia Recovery Unit plan. Additional local populations may be added to this total as additional information is gathered in areas outside the currently designated core areas for this recovery unit.

2. **Abundance criteria will be met when the estimated abundance of adult bull trout among all local populations in the Upper Columbia Recovery Unit (Wenatchee, Entiat, and Methow Core Areas) is between 6,322 to 10,426 migratory fish (see Appendix 2).** Recovered abundance ranges for the Wenatchee (1,876 to 3,176), Entiat (836 to 1,364), and Methow (3,610 to 5,886) Core Areas were derived using the

professional judgement of the team and estimation of productive capacity of identified local populations. Resident life history forms are not included in this estimate, but are considered a research need. As more data is collected, recovered population estimates will be revised to more accurately reflect both the migratory and resident life history components. The established recovered abundance levels assume that threats (including fragmentation of local populations) have been addressed and that each core area is a functioning metapopulation. While the recovered abundance for each core area falls short of long-term idealized estimates for effective population size (see Chapter 1), the Upper Columbia Recovery Team feels that the estimated ranges accurately reflect achievable recovered abundance levels. In the Wenatchee and Methow core areas, the identified recovered abundance levels should prevent inbreeding depression and minimize the loss of genetic variation due to genetic drift. The natural productive capacity of the Entiat Core Area may keep it below 1,000 spawning adults annually, and at risk of genetic drift. The U.S. Fish and Wildlife Service will evaluate the identified abundance levels relative to the maintenance of long-term genetic variation that would provide the population the ability to adapt to natural selection and changing environmental conditions.

3. **Trend criteria will be met when adult bull trout exhibit a stable or increasing trend for at least two generations at or above the recovered abundance level within the Wenatchee, Entiat, and Methow Core Areas.** The development of a standardized monitoring and evaluation program that would accurately describe trends in bull trout abundance is identified as a priority research need. As part of the overall recovery effort, the U.S. Fish and Wildlife Service will take the lead in addressing this research need by forming a multi-agency technical team to develop protocols to evaluate trends in bull trout populations.
4. **Connectivity criteria will be met when specific barriers to bull trout migration in the Upper Columbia Recovery Unit have been addressed.** The Upper Columbia Recovery Unit Team recommends that

to adequately address habitat problems in the Methow Core Area (*e.g.*, low instream flows, grazing, culverts, and diversion dam barriers), and to recover bull trout, basin-wide Habitat Conservation Plans must be developed. The U.S. Fish and Wildlife Service, working with Federal, State, and private entities, and in coordination with local governments, need to secure quality habitat conditions for bull trout. These efforts should be coordinated with ongoing National Marine Fisheries Service salmon recovery actions to avoid duplication in planning and implementation.

Recovery criteria for the Upper Columbia Recovery Unit were established to assess whether recovery actions are resulting in the recovery of bull trout. The Upper Columbia Recovery Unit Team expects that the recovery process will be dynamic and will be refined as more information becomes available. While removal of bull trout as a species listed under the Endangered Species Act (*i.e.*, delisting) can only occur for the entity that was listed (Columbia River Distinct Population Segment), the criteria listed above will be used to determine when the Upper Columbia Recovery Unit is fully contributing to recovery of the population segment.

Research Needs

Based on the best scientific information available, the Upper Columbia Recovery Unit Team has identified recovery criteria and actions necessary for recovery of bull trout within the recovery unit. However, the recovery unit team recognizes that many uncertainties exist regarding bull trout population abundance, distribution, and actions needed. The recovery team feels that if effective management and recovery are to occur, the recovery plan for the Upper Columbia Recovery Unit must be viewed as a “living” document that will be updated as new information becomes available. As part of this adaptive management approach, the recovery unit team has identified research needs that are essential within the recovery unit. Research needs apply to areas where the recovery unit team feels more information is needed in order to accurately

determine full recovery in this recovery unit and to implement effective recovery actions.

Columbia River and Tributaries

Recent information on migration and use of the mainstem Columbia River has been verified. Movements of bull trout tagged and released at Rock Island, Rocky Reach, and Wells Dams have been monitored through tagging studies conducted by the Chelan County Public Utilities District (Kreiter 2001; 2002). In addition, studies conducted by the U.S. Fish and Wildlife Service have verified the movement of adult bull trout into the lower Wenatchee River, and most likely the mainstem Columbia River. The mainstem Columbia River contains core habitat elements for bull trout that are important for migration, feeding, overwintering, and eventual recovery.

The Upper Columbia Recovery Team recommends that current studies on migration and use of the mainstem Columbia River be expanded and coordinated with genetic investigations in order to better understand the role that the Columbia River can play in recovery. Increased knowledge of the use of the mainstem Columbia River may revise core area descriptions and could have management and operational implications for mainstem Columbia River hydropower facilities. Research needs identified in the U.S. Fish and Wildlife Service's Biological Opinion on the "Effects to Listed Species from Operation of the Federal Columbia River Power System" are applicable to mainstem facilities in the Upper Columbia Recovery Unit (USFWS 2000b). Reasonable and prudent measures in the Biological Opinion are consistent with information data gaps identified in the Upper Columbia Recovery Unit. Research designed to investigate problems associated with fish ladder use, entrainment, spill, flow attraction, and water quality should be initiated.

The Upper Columbia Recovery Unit Team also considers the Lake Chelan basin and the Okanogan River basin to be research needs. The Lake Chelan basin historically supported adfluvial bull trout. The Upper Columbia Recovery Team feels that the application of a rigorous methodology to determine presence within tributaries to Lake Chelan is necessary to validate the current status. If bull trout are not found in the basin, the Upper Columbia Recovery Team recommends that a study to assess the feasibility of reintroducing bull trout into the basin be

conducted. Recent investigations (Kreiter 2001) indicated that radio-tagged bull trout temporarily moved into the lower portions of the Okanogan River. Historic evidence of local populations of bull trout in the Okanogan River is limited (N. Wells, U.S. Forest Service, pers. comm., 2001). The Upper Columbia Recovery Unit Team recommends that the potential use of the Okanogan River by bull trout be investigated.

Monitoring and Evaluation

The Upper Columbia Recovery Unit Team realizes that recovery criteria will most likely be revised as recovery actions are implemented and bull trout populations begin to respond. In addition, the Upper Columbia Recovery Unit Team will rely on adaptive management to better refine both abundance and distribution criteria. Adaptive management is a continuing process of planning, monitoring, evaluating management actions, and research. This approach will involve a broad spectrum of user groups and will lay the framework for decision making relative to recovery implementation and ultimately, the possible revision of recovery criteria in this recovery unit.

This recovery unit chapter is the first step in the planning process for bull trout recovery in Upper Columbia Recovery Unit. Monitoring and evaluation of population levels and distribution will be an important component of any adaptive management approach. The U.S. Fish and Wildlife Service will take the lead in developing a comprehensive monitoring approach that will provide guidance and consistency in evaluating bull trout populations. Development and application of models that assess extinction risk relative to abundance and distribution parameters are critical in refining recovery criteria as the recovery process proceeds. Application of agreed upon methods for evaluating recovery would benefit the scientific community and user groups alike.

Genetic Studies

The Upper Columbia Recovery Unit Team recommends that studies be initiated to describe the genetic makeup of bull trout in the mainstem Columbia, Wenatchee, Entiat, and Methow Rivers. This information would be essential for a more complete understanding of bull trout interactions and population dynamics. In addition, a recovery unit-wide evaluation of the current and potential threat of

bull trout hybridization with brook trout is needed. The ability to evaluate the potential harm to specific local populations could be used in prioritizing management actions. Genetic baseline information would also be a necessity in the implementation of any artificial propagation program.

The Role of Artificial Propagation and Transplantation

The Upper Columbia Recovery Unit Team has determined that reaching a recovered condition within the Wenatchee, Entiat, and Methow Core Areas within 25 years could require the use of artificial propagation. Artificial propagation could involve the transfer of bull trout into unoccupied habitat within the historic range (ODFW 1997). In addition, artificial propagation could involve the use of Federal or State hatcheries to assist in recovery efforts (MBTSG 1996). The Upper Columbia Recovery Team recommends that studies be initiated to determine the effectiveness and feasibility of using artificial propagation in bull trout recovery.

Any artificial propagation program instituted in the Upper Columbia Recovery Unit must follow the joint policy of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding controlled propagation of listed species (65 FR 56916). The overall guidance of the policy is that every effort should be made to recover a species in the wild before implementing a controlled propagation program. If necessary, an appropriate plan would need to be approved that considers the effects of transplantation on other species as well as the donor bull trout populations. Transplanting listed species must be authorized by the U.S. Fish and Wildlife Service and meet applicable State fish-handling and disease policies.

While artificial propagation has played an important role in the recovery of other listed fish species, where possible, the overall recovery strategy for bull trout in the Upper Columbia Recovery Unit should emphasize the removal of threats and habitat restoration. Recovery should emphasize identifying and correcting threats affecting bull trout and their habitats. Artificial propagation programs should not be implemented unless reasons for decline have been addressed.

ACTIONS NEEDED

Recovery Measures Narrative

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follows a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. Second-tier tasks that do not include specific third-tier actions are usually programmatic activities that are applicable across the range of the species; they appear in *italic type*. These tasks may have third-tier tasks associated with them (see Chapter 1 for more explanation). Some second-tier tasks may not be sufficiently developed to apply to the recovery unit at this time; they appear in *a shaded italic type*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and are intended to assist in generating information during the comment period for the draft recovery plan, a period when additional tasks may be developed. Third-tier entries are tasks specific to the Upper Columbia Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Upper Columbia Recovery Unit chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, monitoring results become available, or other new information becomes available. Revisions to the Upper Columbia Recovery Unit chapter will likely focus on priority streams or stream segments within core areas where restoration activities occurred, and habitat or bull trout populations have shown a positive response. The Upper Columbia Recovery Unit Team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service for revision of the Upper Columbia Recovery Unit chapter.

1. Protect, restore, and maintain suitable habitat conditions for bull trout.

- 1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.
 - 1.1.1 Investigate alternatives to improve low flow conditions. Investigate alternatives to improve low flow conditions, evaluate ground water/surface water interactions, and evaluate human-induced changes. Specific areas to address include: lower Early Winters Creek, the two diversions at River Miles 1.4 and 0.6, the Methow River from Robinson Creek to Weeman Bride at River Mile 6 below Mazama Bridge, Lost River, Twisp River, Gold Creek near water diversions at River Miles 0.2 and 1.3, Peshastin Creek, Chiwaukum Creek, Chiwawa River, and Icicle Creek in the Wenatchee River.
- 1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.
 - 1.2.1 Reconnect floodplains. Reconnect floodplains and off-channel habitats that provide important spawning and rearing areas. In the Methow basin, the McKinney Mountain and People Mover Dikes should be considered for removal. Support restoration efforts planned for Goat Creek (a channel function restoration project in the lower 1.5 channelized miles and a stream restoration project between River Miles 6.5 and 9.5). Support projects that propose alternatives to maintaining the dike on Lost River. Support projects that propose to restore the lower 2 miles of Early Winters Creek, which has been riprapped and diked, had side-channels cut off, and had trees removed from riparian areas. Restore access to the floodplain and reconnect side channels in the lower 15 miles of the Twisp River.

- 1.2.2 Correct irrigation passage barriers. Develop a comprehensive list of irrigation diversion passage barriers in the Upper Columbia Recovery Unit that impact bull trout and their habitat. Correct identified barriers to allow fish passage, and correct or minimize impacts they have on bull trout habitat.
 - 1.2.3 Screen diversions and irrigation ditches. Screen known water diversion and irrigation ditches to meet State, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service screening criteria.
 - 1.2.4 Assess impacts from proposed Lake Wenatchee Dam. Assess direct and indirect effects to bull trout of the proposed damming of Lake Wenatchee, including impacts to current populations and habitat.
- 1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.
- 1.3.1 Minimize further shoreline and floodplain development. Reduce current impacts from shoreline and floodplain development along the mainstem Methow, Entiat, and Wenatchee rivers. Minimize further development that will constrict or constrain the channel, degrade riparian areas, negatively impact ground water and surface water interactions, or in any other way degrade stream channel functions.
 - 1.3.2 Develop road management strategy. Develop a road management strategy in coordination with U.S. Forest Service Road Analysis to enhance bull trout connectivity and restore habitat.

- 1.3.3 Develop and coordinate access and travel management plans. Coordinate public and private land owner development of access and travel management plans that will minimize effects of roads in bull trout watersheds.
- 1.3.4 Identify and repair, remove, or relocate culverts. Identify and repair, remove, or relocate culverts that are barriers for fish migration, restrict connectivity, or inhibit downstream transport of substrate and woody debris. Areas of concern include: Peshastin and Nason Creeks (Wenatchee River), Twisp River, Beaver Creek, Gold Creek, Little Bridge Creek, and East Fork Buttermilk Creek (Methow River).
- 1.3.5 Identify and repair, remove, or relocate roads. Identify and repair, remove, or relocate roads that are barriers for fish migration, restrict connectivity, increase sediment delivery, intercept ground water and surface water, detrimentally effect riparian and floodplain function, or alter normal hydraulic processes.
- 1.3.6 Avoid placement of new roads in riparian areas.
- 1.3.7 Assess forest practice regulations. Assess the effectiveness of current forest practice regulations to protect bull trout habitat.
- 1.3.8 Reduce road density and road-related sediment delivery. Reduce road density and road-related sediment delivery in bull trout core areas. In the Methow Core Area, priority watersheds include: Goat Creek, Beaver Creek, Chewuch River, Wolf Creek and tributary Gate Creek, Early Winters Creek, lower Methow River, Twisp River and tributaries Little Bridge Creek and Buttermilk Creek. In the Wenatchee Core Area, priority watersheds include: lower

Chiwawa River, middle Chiwawa River, Lake Wenatchee, lower White River, lower Little Wenatchee, upper Little Wenatchee, lower Nason Creek, upper Nason Creek, the headwaters of Nason Creek, Wenatchee River (upper, middle, and lower portions), lower Icicle Creek drainage, and Peshastin Creek. In the Entiat Core Area, priority watersheds include: lower Entiat River, middle Entiat River, lower Mad River, middle Mad River, and the upper Mad River.

- 1.3.9 Develop and implement habitat restoration and protection guidelines. Develop and implement habitat restoration and protection guidelines for bull trout that restore or maintain habitat elements (*e.g.*, sediment delivery, water temperature, normative hydrologic function) to provide for recovery.
- 1.3.10 Ensure enforcement of mineral prospecting and placer mining regulations. Ensure mineral prospecting and placer mining activities comply with the Washington State Hydraulic Code (Gold-N-Fish pamphlet).
- 1.3.11 Maintain unroaded portions of bull trout watersheds in current roadless condition.
- 1.3.12 Address access road impacts. Identify and close, or provide law enforcement for, roads that increase risk of poaching and fishing pressure, especially in bull trout spawning and staging areas.
- 1.3.13 Monitor mining activities. Monitor mining activities for compliance with the Gold Pamphlet and recovery actions to determine the effectiveness of regulations and recovery

actions in providing desired habitat and water quality conditions.

- 1.3.14 Ensure that bull trout are considered in all planning phases of new gold mining operations. Ensure that bull trout are considered in all planning phases of new gold mining operations in the North Creek drainage in the Twisp River and Chikamin Creek.
- 1.3.15 Implement and monitor stream nutrient enhancement projects. Implement projects to distribute salmon and steelhead carcasses in streams to increase stream nutrients and aid in the restoration of historic nutrient flows. Monitor their effectiveness.
- 1.3.16 Quantify grazing impacts. Identify and investigate grazing impacts and quantify impacts to bull trout habitat in the Upper Columbia Recovery Unit (*e.g.*, Rainy, Wolf, Goat, Buttermilk, Gold, and Libby Creeks). Focus on impacts to riparian areas and stream channel condition.
- 1.3.17 Develop and implement livestock grazing plans. Develop, implement, and adaptively manage livestock grazing plans that include actions (*e.g.*, riparian fencing), performance standards, and targets for floodplains, riparian vegetation, stream banks and channels, and wetlands that protect bull trout habitat and water quality.
- 1.3.18 Exclude grazing from sensitive habitat areas. Exclude grazing from sensitive bull trout habitat areas (*e.g.*, spawning grounds, early rearing habitats) during spawning and the incubation period (*e.g.*, September-April).

- 1.3.19 Identify and mitigate habitat impacts from highways and railroads. Identify reaches in the Wenatchee and Methow where highways and railroads have altered bull trout habitat (*e.g.*, Wenatchee River, Nason Creek, Peshastin Creek, Early Winters Creek, and the upper Methow River) and recommend mitigative actions.
- 1.3.20 Coordinate with grazing interests to minimize grazing disturbance. Coordinate, work with, and support conservation districts, counties, and private landowners to evaluate grazing disturbances and implement corrective actions in bull trout habitat.
- 1.3.21 Reduce sediment loading to streams. Reduce sediment loading from irrigation return flow and non-point source runoff (*e.g.*, Wolf Creek irrigation ditch).
- 1.3.22 Identify and, where feasible, correct man-made barriers to fish passage in foraging and refugia habitats. Identify and, where feasible, correct man-made barriers to fish passage in non-local population streams that provide foraging and high water refuge habitat.
- 1.3.23 Restore and protect habitat that is impacted by recreational campgrounds. Take corrective actions to restore and protect habitat that is impacted by recreational campgrounds. Priority areas include: Tumwater Campground at the confluence of Chiwaukum Creek and the Wenatchee River, Nason Creek Campground and dispersed sites on Nason Creek, Riverside Campground on the Little Wenatchee River and dispersed sites on the Little Wenatchee River, Pine Flat Campground on the Mad River, Roads End Campground on the Twisp River, and dispersed camping sites on the Chiwawa River.

- 1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.
 - 1.4.1 Evaluate bull trout passage at Wells, Rock Island, and Rocky Reach Dams, and initiate passage studies at Wanapum Dam. Continue evaluation of bull trout passage at Wells, Rock Island, and Rocky Reach dams. Focus on level of use and adequacy of current passage facilities. Initiate bull trout passage studies at Wanapum Dam.
 - 1.4.2 Assess feasibility of providing fish passage at Leavenworth National Fish Hatchery. Improve fish passage at Leavenworth National Fish Hatchery if feasible.
 - 1.4.3 Evaluate downstream passage at Tumwater and Dryden Dams. Evaluate downstream passage at Tumwater and Dryden Dams, and if warranted investigate methods necessary to improve downstream passage.
- 1.5 *Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.*
2. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
 - 2.1 *Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.*
 - 2.2 *Enforce policies for preventing illegal transport and introduction of nonnative fishes.*
 - 2.3 *Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.*

- 2.4 *Evaluate biological, economic, and social effects of control of nonnative fishes.*
- 2.5 Implement control of nonnative fishes where found to be feasible and appropriate.
 - 2.5.1 Evaluate opportunities for experimental removal of brook trout or other competing nonnative fish species. Evaluate opportunities for experimental removal of brook trout or other competing nonnative fish species from selected streams. Initial priority areas include Twisp River, Chikamin and Minnow Creeks and Shaefer Lake on the Chiwawa River.
- 2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.
 - 2.6.1 Evaluate impacts of nonnative fish species on bull trout. Evaluate impacts of nonnative fish species on bull trout, especially when present in local populations. Evaluate predation, hybridization, and competition impacts to all life stages.
- 3. Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.
 - 3.1 *Develop and implement State and Tribal native fish management plans, and integrate adaptive research.*
 - 3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

- 3.2.1 Ensure compliance with harvest regulations. Ensure compliance with harvest regulations and policies, and target bull trout spawning and staging areas for enforcement in the Upper Columbia Recovery Unit. Priority areas include Mad River, Panther Creek, Rock Creek, Chiwawa River, Twisp River, and Lake Wenatchee based on past observations of poaching.
- 3.2.2 Reduce angler pressure. Reduce angler pressure in areas where incidental mortality continues to be detrimental to recovery. Utilize innovative techniques such as seasonal or permanent road closures, and establishment of conservative regulations or fisheries management policies.
- 3.2.3 Provide educational opportunities and materials to anglers. Provide anglers with information about bull trout identification, special regulations, and how to reduce hooking mortality of bull trout caught incidentally in recreational fisheries.
- 3.2.4 Develop and implement a bull trout fishery management plan. Develop and implement a bull trout fishery management plan for the Upper Columbia Recovery Unit to assess harvest and incidental take during other fisheries (e.g., whitefish season).
- 3.2.5 Increase natural forage (prey) base. Implement restoration actions that increase natural production of salmon, steelhead, and other native species thereby improving the natural forage base for bull trout.
- 3.2.6 Evaluate impacts to bull trout from the general fishing season in the Lost River. Monitor effects of the current harvest regulations for the Lost River and evaluate their

adequacy to protect bull trout spawner abundance in this important local population.

- 3.2.7 Monitor scientific collection. Monitor scientific collection and regulate collection methods (techniques, intensity, timing). Specifically, address possible take of bull trout during spring chinook egg collection and recommend corrective actions if necessary.
- 3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.
 - 3.3.1 Discontinue stocking of brook trout. Discontinue stocking of brook trout in areas where impacts to bull trout may occur. Review stocking plans for lakes that are in bull trout watersheds and recommend changes that would benefit bull trout.
- 3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.
 - 3.4.1 Evaluate and implement harvest regulations that reduce nonnative fish populations impacting bull trout. Evaluate and implement harvest regulations that reduce nonnative fish populations where bull trout will benefit. Ensure that the liberalized limits targeting nonnatives do not increase incidental catch of bull trout.
- 4. Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
 - 4.1 *Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.*

- 4.2 *Maintain existing opportunities for gene flow among bull trout populations.*
- 4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.
 - 4.3.1 Establish genetic reserve protocols. Establish genetic reserve protocols and standards for initiating, conducting, and evaluating artificial propagation programs.
 - 4.3.2 Establish genetic baselines. Genetic baseline descriptions of bull trout in the Columbia, Wenatchee, Entiat, and Methow Rivers is essential for a complete understanding of bull trout interactions and population dynamics.
 - 4.3.3 Evaluate hybridization with brook trout. Recovery Unit wide evaluation of the current and potential threat of bull trout hybridization with brook trout is needed. The ability to evaluate the potential harm to specific local populations can be used in prioritizing management actions.
 - 4.3.4 Determine feasibility and appropriateness of artificial propagation. Reestablishment of local populations within the Upper Columbia Recovery Unit may require the use of artificial propagation. Initiate studies to determine the effectiveness and feasibility of using fish transfers and hatcheries to assist in future reintroduction efforts.
- 5. Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.
 - 5.1 *Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.*

- 5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.
 - 5.2.1 Develop and implement a monitoring program. Develop a monitoring program to assess the contribution of the resident life history form to overall population abundance.
- 5.3 *Conduct evaluations of the adequacy and effectiveness of current and past Best Management Practices in maintaining or achieving habitat conditions conducive to bull trout recovery.*
- 5.4 *Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.*
- 5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.
 - 5.5.1 Evaluate the current and potential bull trout use of the Columbia River and lower mainstem portions of the Methow, Entiat, and Wenatchee Rivers. Determine habitat use, foraging requirements, and migrational patterns within these mainstem areas.
 - 5.5.2 Investigate the potential and feasibility for re-introducing bull trout to the Chelan basin.
 - 5.5.3 Investigate potential use of the Okanogan River by bull trout, and investigate habitat suitability.
 - 5.5.4 Conduct problem assessments for bull trout and identify site-specific threats that may be limiting recovery efforts. Coordinate with Water Resource Inventory Areas and the Northwest Power Planning Council's Subbasin Planning

process to fill data gaps related to the identification of site-specific threats that may be limiting recovery efforts.

5.5.5 Conduct population surveys. Conduct intensive population surveys to determine presence of bull trout and to fully describe the distribution of juvenile, sub-adult, and adults in the Upper Columbia Recovery Unit.

5.5.6 Assess the feasibility for using Patterson Lake bull trout to reestablish Methow River local populations.

5.6 *Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.*

6. Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.1.1 Protect high quality habitats. Protect existing high quality habitats in the Upper Columbia Recovery Unit and provide for long-term habitat protection through purchase from willing sellers, conservation easements, and management plans (e.g., Entiat River, Peshastin Creek, White River, Chiwawa River, and mainstem Wenatchee and Methow Rivers). A conservation easement to secure riparian buffers should be pursued on the upper Methow River between Goat Creek and Mazama where accelerated erosion is occurring in areas impacted by agriculture and residential development.

6.1.2 Develop basin-wide habitat conservation efforts. Work with conservation districts, counties, State agencies, and

private landowners to develop basin-wide habitat conservation efforts (*e.g.*, Habitat Conservation Plans) to protect bull trout and their habitat in the Upper Columbia Recovery Unit (priority is the Methow River).

- 6.1.3 Work with watershed groups and landowners. Work with and support local watershed groups and private landowners to assess bull trout status, actions needed, and implementation of recovery.

- 6.2 Use existing Federal authorities to conserve and restore bull trout.
 - 6.2.1 Assess impacts to bull trout during hydropower relicensing. Continue bull trout monitoring in the mainstem Columbia to gather necessary information to describe the effects of project operations at Wells, Rocky Reach, and Rock Island Dams. This information will be necessary to complete section 7 consultation for bull trout during the upcoming Federal Energy Regulatory Commission relicensing process.

- 6.3 Enforce existing Federal and State habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.
 - 6.3.1 Ensure implementation of Washington State habitat protection laws.

 - 6.3.2 Ensure full compliance monitoring of Forest and Fish Report standards. Ensure full compliance monitoring associated with Forest and Fish Report standards and modify rules through adaptive management when indicated by effectiveness monitoring.

- 6.3.3 Implement Federal land management plans that protect fish habitat (e.g., INFISH).
 - 6.3.4 Develop, implement, and enforce water quality standards for surface water in the State of Washington. Develop, implement, and enforce water quality standards specific for bull trout.
 - 6.3.5 Increase monitoring and enforcement of Hydraulic Permit Applications in the State of Washington.
 - 6.3.6 Develop and implement county and local habitat protection laws and ordinances.
7. Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.
- 7.1 *Convene annual meetings of each recovery unit team to generate progress reports on implementation of the recovery plan for the U.S. Fish and Wildlife Service.*
 - 7.2 *Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts (coordinate with 5.1).*
 - 7.3 Revise the scope of recovery as suggested by new information.
 - 7.3.1 Periodically review progress toward recovery goals and assess recovery task priorities. Annually review progress toward population and adult abundance criteria and recommend changes, as needed, to the Upper Columbia Recovery Unit chapter. In addition, review tasks, task priorities, completed tasks, budget, timeframes, particular successes, and feasibility within the Upper Columbia Recovery Unit.