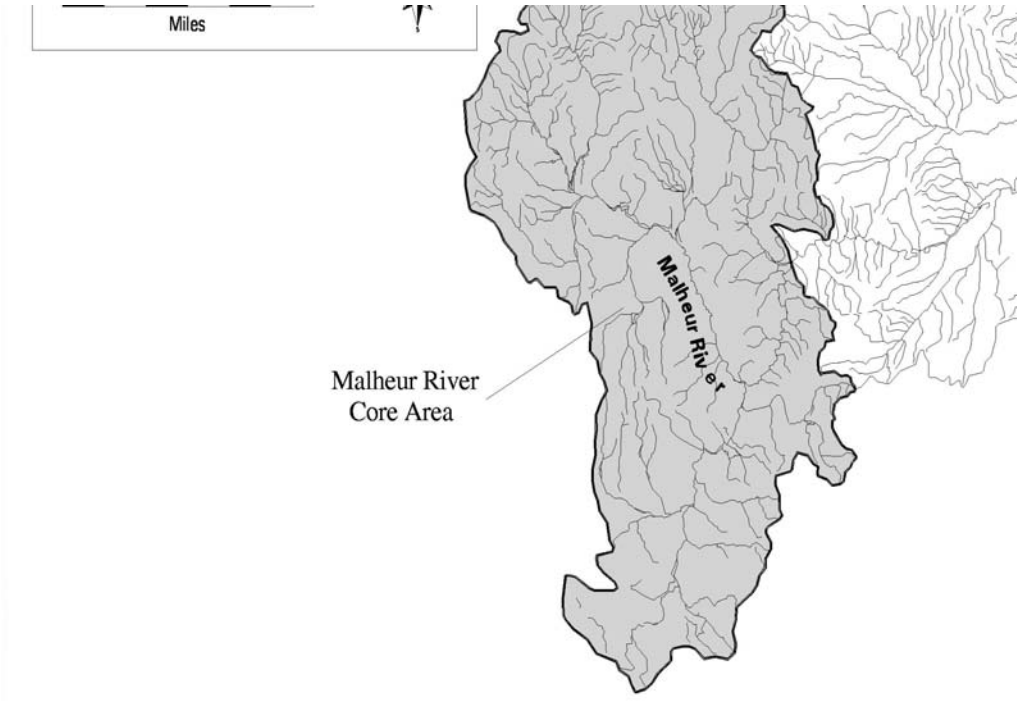
STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit. The combination of core habitat (*i.e.*, habitat that could supply all the necessary elements for the long-term security of bull trout including both spawning and rearing as well as 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.

Malheur Core Area. For purposes of recovery, the Malheur Recovery Unit contains one core area, the Malheur Core Area, which encompasses tributaries containing two local populations (and additional potential local populations as identified by the recovery unit team) and the mainstem Malheur River from headwaters downstream to Namorf Dam. Although bull trout would had seasonal access to the Malheur River downstream of Namorf Dam, there is no spawning

Figure 3. Map of the Malheur Recovery Unit with bull trout core area delineated.



and juvenile rearing habitat downstream of this point. Migration and overwinter suitableing/foraging habitat downstream to Namorf Dam is sufficient to support recovered populations.

The Malheur Core Area (Figure 3) includes two local populations located in the headwaters of the North Fork Malheur River and the Upper Malheur River subbasins. Additional research on homing fidelity may indicate further division into additional local populations is appropriate.

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 throughout the species' native range, so the species can be delisted.** To achieve this goal the following objectives have been identified for bull trout in the Malheur Recovery Unit:
Maintain the current distribution of bull trout within the core area and re-establish bull trout in previously occupied habitats in the Upper Malheur River and tributaries and the North Fork Malheur River and tributaries.

- Maintain stable or increasing trends in abundance of bull trout in the Malheur Recovery Unit. This will require increasing abundance within the two local populations (Upper Malheur and North Fork Malheur).

- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

- Conserve genetically diverse local populations of bull trout within the Malheur Recovery Unit by providing opportunities for genetic exchange between the local populations. This can best be achieved by ensuring connectivity between the North Fork Malheur River and the Upper Malheur River.

Recovery criteria for the Malheur Recovery Unit reflect the stated objectives and consideration of population and habitat characteristics within the recovery unit. The Malheur Recovery Unit Team evaluated the current status of bull trout based on four population elements. The four elements were: (1) number of local populations, (2) adult abundance (defined as the number of sexually mature fish present in a core area in a given year), (3) productivity (defined as a measure of population trend and variability), and (4) life history forms (as an indicator of the functional connectivity of the system). For each element, the Malheur Recovery Unit Team classified bull trout based on relative risk categories.

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 Malheur Recovery Unit Team classified bull trout intorelative risk categories based on the best available data and the professional judgment of the team.

The Malheur 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 Malheur 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.

This approach to developing recovery criteria acknowledges that the status of populations in some core areas may remain 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 Malheur 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 (Meffe and Carroll 1994) (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.

For the Malheur Core Area, there are currently 2 known local populations (Upper Malheur River and North Fork Malheur River). Based on the aforementioned guidance, the Malheur Core Area is at increased risk from stochastic events.

Adult Abundance. The recovered abundance levels in the Malheur 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 (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 census number of 50 to 100 spawners per year was needed to minimize potential inbreeding effects within local populations. Furthermore, a census population size between 500 and 1000 adults in a core area is needed to minimize the deleterious effects of genetic variation due to 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 from genetic drift

From 1996 to 2001, annual spawner survey estimates in the North Fork Malheur local population have averaged approximately 95 redds per year. Based on this information, this local population is not considered at risk from inbreeding depression. Limited data on the Upper Malheur River local population precluded

evaluation of inbreeding risks. Overall, the Malheur Core Area most likely contains less that 1,000 spawning adults and is considered at risk from 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, indicate increased extinction risk. Therefore, the reproductive rate should indicate 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 which is below recovered abundance levels but 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.

Connectivity. The presence of the migratory life history form within the Malheur Recovery Unit was used as an indicator of the functional connectivity of the recovery unit and both core areas. If the migratory life form was absent, or if the migratory form is present but local populations lack connectivity, the core area was considered to be at increased risk. If the migratory life form persists 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. Finally, 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.

Migratory bull trout persist in the Malheur River and at least partial connection exists between local populations within the core area and were considered at intermediate risk.

Recovery Criteria

Recovery criteria for bull trout in the Malheur Recovery Unit are the following:

1. **Bull trout are distributed among 2 or more local populations in the recovery unit within the Malheur Core Area.** In a recovered condition one or more local populations would occur within the Upper Malheur River and one or more local populations would occur within the North Fork Malheur River. There is potential to further separate the Upper Malheur River into 2 or 3 local populations, and the North Fork Malheur River into 2 or more local populations. However, additional population studies and a better understanding

of bull trout fidelity to their natal streams is needed to further define local populations in the recovery unit. There may be potential to expand the current distribution of bull trout into additional tributaries within their historic range, such as Little Malheur River (North Fork Malheur tributary) and Crooked Creek, Bosonberg Creek, McCoy, and Corral Basin (Upper Malheur River tributaries). The identified recovered distribution may place the Malheur Core Area at increased risk from stochastic events. Natural habitat features within the Malheur River Basin may limit expansion of bull trout distribution to idealized levels identified in this chapter. After additional population and genetic information is collected, recovery criteria may be revised, and the risk level associated with stochastic events re-evaluated.

2. **Estimated abundance of adult bull trout in the Malheur Recovery Unit is between 2,000 and 3,000 individuals distributed between the two local populations.** The recovery unit team expects to achieve this criteria by securing the current population and increasing the abundance of migratory adults in Upper Malheur River. The recovered abundance range was derived using the professional judgement of the recovery unit team and estimation of productive capacity of identified local populations. This abundance level would mean that the core area and local populations would not be at risk from inbreeding or genetic drift, respectively. These goals may be refined as more information becomes available, through monitoring and research.

3. **Adult bull trout exhibit a stable or increasing trend for at least 2 generations at or above the recovered abundance level within the**

Malheur Core Area. The development of a standardized monitoring and evaluation program which 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. **Specific barriers inhibiting bull trout movement and recovery in the Malheur Recovery Unit have been addressed, ensuring opportunities for connectivity among local populations within the core area.** This means addressing passage at Agency Dam on the North Fork Malheur, Warm Springs Dam on the Malheur River, all unscreened diversions in core areas, and all impassable culverts. Additional studies will be needed to determine the feasibility of providing two-way passage at Beulah and Warm Springs Dams. Reduction or elimination of threats from brook trout interaction in the Upper Malheur will need to be accomplished prior to restoration of passage to ensure the success of bull trout recovery. While the major connectivity issues in the

Malheur Recovery Unit are associated with Agency Dam and Warm Springs Dam, additional gains in recovery of bull trout populations through expansion of habitat within the two subbasins can be achieved by restoring passage over and around barriers at road crossings, culverts, and water diversions. The known barriers are listed in Appendix B and specific action to address them are highlighted in the recovery narrative portion of this plan. There may be others that have not been identified.

Recovery criteria for the Malheur Recovery Unit were established to assess whether recovery actions have resulted in the recovery of bull trout. The Malheur Recovery Unit Team expects that the recovery process will be dynamic and require refinements as more information becomes available over time. While removal of bull trout as a species 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 Malheur Recovery Unit Recovery Unit is fully contributing to recovery of the population segment.

Research Needs

Based on the best scientific information available, the recovery unit team has identified recovery criteria and actions necessary for recovery of bull trout within the Malheur Recovery Unit. However, the recovery unit team recognizes

that many uncertainties exist regarding bull trout population abundance, distribution, and recovery actions needed. The recovery unit team feels that if effective management and recovery are to occur, the recovery plan for the Malheur Recovery Unit should be viewed as a "living" document, to be updated as new information becomes available. As part of this adaptive management approach, the Malheur Recovery Unit Team has identified essential research needs within the recovery unit.

Monitoring and Assessment. The Malheur Recovery Unit Team based estimates of recovered abundance levels and number of local populations on the best available information and professional judgement. Information on historical abundance levels and distribution of spawning populations is limited. The recovery unit team realizes that recovery criteria will most likely be revised as recovery actions are implemented and bull trout populations begin to respond. The 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 adaptive management approach will identify actions that maximize the ability to achieve recovery objectives. In addition, this approach will provide a better understanding of key uncertainties, crucial to long-term management actions.

Monitoring and evaluation of population levels and distribution are important components 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. An important component in recovery implementation and the use of adaptive management will be the evaluation of recommended actions.

The Malheur Recovery Unit Team has identified an urgent need for the development of a standardized monitoring and assessment program that would more accurately describe current status of bull trout within the recovery unit, as well as identify improvements in current sampling protocols that would allow for monitoring the effectiveness of recovery actions. Development and application of models that assess population trend and extinction risk will be useful in refining recovery criteria as the recovery process proceeds.

Additional research needed for recovery include studies that evaluate effectiveness of restoration techniques, limiting factors analysis in watersheds with historical bull trout habitat and potential habitat, identification of sediment sources and impacts to bull trout, and continuation of life history studies.

Genetic Studies. The Malheur Recovery Unit Team recommends that studies be initiated to describe the genetic makeup of bull trout in the core area. Genetic information on local populations within the core area is necessary for a more complete understanding of bull trout interactions and population dynamics, and may lead to revision of recovery criteria. 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.

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 species' range; they appear in *italic type*. These tasks may or may not 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 (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and 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 Malheur Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Malheur Recovery Unit chapter should be updated or revised when recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Malheur 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 Malheur Recovery Unit Team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service.

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 Assess sediment sources in Malheur Basin affecting bull trout. Identify road-related sediment problem areas in the Malheur Core Area. Examine the ways roads capture and channel runoff, and changes in surface runoff associated with soil compaction. Identify the source of stream channel

aggradation in the Malheur River downstream of Highway 20.

1.1.2 Stabilize roads, crossings, and other sources of sediment delivery. Address sediment issues identified in the upper Malheur River watershed assessment, (*e.g.*, road related sediment in Lake and Bosonberg Creeks) and as a result of task 1.1.1. Correct sedimentation at the ford that accesses the Burns Paiute Tribe property in Logan Valley. Construction of a culvert crossing (several culverts) that will sustain a 50 year flood event has been proposed.

1.1.3 Assess and mitigate effects on bull trout from nonpoint source pollution. Temperature and sedimentation are the most pressing nonpoint source pollution issues affecting bull trout. Data collection will be used for designation of Total Maximum Daily Loads.

1.1.4 Increase monitoring of sediment inputs on the Malheur National Forest. Additional monitoring is needed to assess sediment to bull trout spawning and rearing habitat resulting from wildfires in the Malheur Core Area (Snowshoe and Corral Basins).

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 Identify and implement opportunities for two-way passage at major dams. Agency and Warm Springs Dams and the Drewsey diversion are priorities.

1.2.2 Provide passage at transportation/road-related barriers identified in completed and ongoing surveys. Oregon Department of Transportation surveys have been completed for State and County roads in Oregon. The U.S. Forest Service completed a culvert inventory on the Forest in 2001, but analysis has not been completed as barriers pertain to bull trout. Establish priorities for passage provision and implement necessary actions.

1.2.3 Install appropriate fish screens and passage structures around diversions and/or remove related migration barriers. High priorities for screening include diversion on Big Creek that conveys water to the Burns Paiute Tribal property (Oxbow Ranch) on the upper Malheur River and the Castle Rock diversions on the North Fork Malheur.

1.2.4 Restore connectivity and opportunities for migration by improving instream flows. Use the Oregon Department of Fish and Wildlife instream flow priorities as a guide. See list in Appendices B, C, D, and E.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.

1.3.1 Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning areas. Summit Creek, the Malheur River downstream of Logan Valley, and Crooked Creek in the Upper Malheur subbasin have suppressed woody vegetation in reaches that need this component to become stable, as well as tributary streams to the North Fork Malheur on the lower end of the Malheur National Forest.

1.3.2 Reduce grazing impacts in all bull trout spawning areas. Implement measures to reduce livestock impacts to streams, (*e.g.*, fencing, changes in timing and use of riparian pastures, off-site watering and salting), to accomplish this task. Areas that would benefit from shade restoration include lower Lake Creek, lower Big Creek, lower Bosonberg Creek, lower McCoy Creek, Crane Creek, and Buttermilk Creek, as well as, private and tribal lands in Logan Valley. The highest grazing management priority for the U.S. Fish and Wildlife Service is that no direct effects occur to spawning fish or redds after August 15.

1.3.3 Review habitat information to identify and prioritize opportunities for channel restoration in Lake Creek. Design and implement projects based on findings. Lake Creek is an important bull trout spawning stream that is impacted by

sediment from roads, the ford on Tribal land, and is lacking large wood.

1.3.4 Improve instream habitat in the Malheur Core Area. Implement INFISH guidelines (USFS 1995). Use existing habitat surveys or new surveys if necessary to identify opportunities to improve habitat complexity and restore channel morphology.

1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.

1.4.1 Review reservoir operational concerns and provide operating recommendations. Improve where needed, water level manipulation, methods of release, entrainment, minimum fisheries pool, and fish passage. Reservoirs of highest concern are Beulah and Warm Springs Reservoirs.

1.4.2 Establish and provide instream flows downstream from reservoirs and stabilize flow regimes. Improve flows in the winter downstream of Beulah Reservoir from October 15 until the irrigation season begins in the spring, to improve the suitability of this reach as overwintering habitat for bull trout that pass through or over Agency Dam.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

1.5.1 Assess current and historical effects of upland management on changes to the hydrograph, (*e.g.*, timing and magnitude of peak flows) in all spawning tributaries. Restore vegetation in forested portions of the Malheur Core Area in areas where bull trout spawning and juvenile rearing occur.

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 Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Increase education and outreach to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.3.1 Develop and implement an educational effort to address problems and consequences of unauthorized fish introductions. Curtail illegal introductions of crappie in Beulah Reservoir (discovered in 2001).

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 Implement brook trout removal effort(s) wherever feasible and biologically supportable. Prioritize streams in the upper Malheur River that contain brook trout x bull trout hybrids for removal effort and implement action.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

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 integrating adaptive research.

3.1.1 Incorporate bull trout recovery actions into The Oregon Plan for Salmon and Watersheds and the Pacific Northwest Power Planning Council Subbasin plans. Request assistance with implementation of recovery strategies for bull trout through both planning processes.

3.1.2 Coordinate bull trout recovery with recovery efforts, management plans, etc. of other species, such as redband trout, in the Malheur Core Area.

3.2 Evaluate and prevent over harvest and incidental angling mortality of bull trout.

3.2.1 Maintain bull trout as high priority for Oregon's Cooperative Enforcement Program.

3.2.2 Increase information outreach to anglers. Provide information on bull trout identification, special regulations, methods to reduce hooking mortality of bull trout caught incidentally, and the value of bull trout and their habitat and their place in the ecosystem.

3.2.3 Improve and implement fisheries management guidelines and policies designed to protect native species. Some examples include the Oregon Draft Native Fish Conservation Policy and the Malheur River Basin Fish Management Plan.

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 Determine site-specific levels of competition and hybridization with introduced sport fish and assess impacts of those interactions. Assess severity of threat due to hybridization with brook trout in the Upper Malheur local population.

3.4 Evaluate effects of existing and proposed sport fishing regulations on 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.

4.1.1 Develop a genetic management plan. Develop a genetic management plan for the Malheur Recovery Unit including the establishment of genetic baselines for each local population, monitoring genetic changes in existing local

populations, determination of new local populations, and identification of actions needed to maintain existing opportunities for gene flow among bull trout populations.

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.

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.

5.1.1 Evaluate effectiveness of different habitat restoration techniques used in restoring stream functions and local bull trout populations in the Malheur Core Area.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.2.1 Identify site-specific threats that may be limiting bull trout in watersheds with historical bull trout habitat. Use the list in Appendix E to prioritize work.

5.2.2 Determine the movement and seasonality of use of different habitat types by adult and sub-adult migratory bull trout in multiple streams, with emphasis on reservoirs (*e.g.*, Beulah and Warm Springs) and mainstem rivers in the Malheur Core Area.

5.2.3 Investigate potential for restoring historic prey base by reintroducing anadromous species, and take action based on findings. The Burns Paiute Tribe has a proposal before the Northwest Power Planning Council to assess the feasibility of the upper Malheur watershed to support reintroduction of

anadromous population above Beulah and Warm Springs reservoirs (NWPPC 2002).

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 Review and update databases for bull trout distribution records. Including StreamNet (2002), which provides data and data services for fish in the Pacific Northwest.

5.5.2 Conduct surveys in potential habitat in the Malheur Core Area where bull trout status is unknown or recolonization is anticipated.

5.5.3 Determine life history requirements of resident and migratory bull trout local populations in the Malheur Core Area. Knowledge of specific requirements of bull trout in this recovery unit will facilitate their management.

5.5.4 Determine consequences of genetic fragmentation and isolation due to human-made barriers. Examples include Agency and Warm Springs Dams, and impassable diversions and culverts.

5.5.5 Evaluate food web interactions in drainages most affected by introduced fishes, reservoir operations, loss of anadromous species (prey base/nutrients), etc. Studies are underway in Beulah Reservoir to study the predator/prey relationship between bull trout and other species in the reservoir. Some research has been completed on brook trout bull trout interaction in the Upper Malheur subbasin.

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 Provide long-term habitat protection. Explore opportunities to protect bull trout habitat through land purchase from willing sellers, conservation easements, management plans, land exchanges, etc. Promote collaborative efforts to establish or support existing local watershed groups and Soil and Water Conservation Districts to accomplish site specific protection/restoration activities. Priority reaches in the Malheur Recovery Unit that would benefit from this action include the North Fork Malheur between Beulah Reservoir and the National Forest boundary, Bosonberg Creek, Lake Creek, McCoy Creek, Big Creek, and Crane Creek.

6.1.2 Work cooperatively with the Burns-Paiute tribal government to implement recovery actions.

6.1.3 Develop educational materials on bull trout and their habitat needs to provide to landowners and interested public parties. Some examples include information on watershed form and function, riparian and channel restoration, and large wood placement.

6.1.4 Identify and pursue opportunities to implement recovery strategies. Garner support from management agencies, pursue cooperative funding, partnerships, challenge cost share opportunities, and other private and governmental grants; and utilize mitigation and natural resource damage settlement funds as available.

6.1.5 Integrate watershed analyses and assessments and restoration activities on public and private lands. Current restoration initiatives include the Total Maximum Daily Load process

and Senate Bill 1010 water quality management plans, watershed council activities, and Federal watershed analyses. Sites that would benefit from this action include Summit and Crooked Creeks in the Upper Malheur River.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.3 Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

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 review progress on recovery plan implementation.

7.1.1 Develop an annual work plan to support implementation in the Malheur Recovery Unit.

7.2 Assess effectiveness of recovery efforts.

7.3 Revise scope of recovery as suggested by new information.

7.3.1 Periodically review progress towards recovery goals and assess recovery task priorities. Annually review progress toward population and adult abundance criteria and recommend changes, as needed, to the Malheur Recovery Unit chapter. In addition, review tasks, task priorities, completed tasks, budget, time frames, particular successes, and feasibility within the Malheur Recovery Unit.