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, as well as for 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.

Three core areas were defined for this recovery unit, one in the Imnaha River subbasin (Oregon), one in the Sheep Creek subbasin (Idaho) and one in the Granite Creek subbasin (Idaho) (Figure 2). The Imnaha River Core Area encompasses tributaries containing local populations (both current and potential as identified by the recovery unit team) and the mainstem Imnaha River from the headwaters downstream to the Snake River. The Sheep Creek Core Area encompasses tributaries containing a local population and the mainstem from the headwaters downstream to the Snake River. The Granite Creek Core Area encompasses tributaries containing a local population and the mainstem from the headwaters downstream to the Snake River.

Imnaha Core Area. In a recovered condition, this core area includes four natural, local populations: Imnaha River, Big Sheep Creek, Little Sheep Creek and McCully Creek. This core area also includes one derived, local population in the Wallowa Valley Improvement Canal. The canal has been colonized by native bull trout, mostly originating from Big Sheep Creek above the diversion. Functionally, bull trout from upper Big Sheep Creek and in the canal act as a fifth population. Some of these populations may represent a single, local population whereas others may consist of more than one local population. For example, the Imnaha River Core Area may have one local population in the North Fork and one in the South Fork. For the present however, or until research shows otherwise, each is considered one local population. Many of these local populations (*i.e.*, McCully Creek) have the potential to become core areas if

has effectively isolated bull trout in upper Big Sheep Creek and McCully Creek. Research is needed to evaluate the impacts of this isolation on (for example) population genetics and population viability.

Identification of these barriers does not imply that other actions associated with passage and habitat degradation are not crucial for recovery to occur. To achieve recovery in the Imnaha-Snake Rivers Recovery Unit, all four recovery criteria (local populations, abundance, population trends, and barrier removal) must be achieved. It is unlikely that meeting all four recovery criteria will be accomplished by removing or otherwise addressing only the barriers identified in criteria four.

Table 1. Current local populations of bull trout within the Imnaha-Snake Rivers Recovery Unit (Oregon and Idaho) and streams with potential to expand existing bull trout distribution.

Core Area	Local Populations	Creeks with Expansion Potential
Imnaha River	Imnaha and upper tributaries	Lightning Creek
	Big Sheep and tributaries (above and including Wallowa Valley Improvement Canal)	
	Little Sheep and tributaries	
	McCully Creek and tributaries	
	Big Sheep and tributaries (below Wallowa Valley Improvement Canal)	
Sheep Creek	Sheep Creek	
Granite Creek	Granite Creek	

Recovery criteria for the Imnaha-Snake Rivers Recovery Unit were established to assess whether recovery actions are resulting in the recovery of bull trout. The Imnaha-Snake Rivers 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 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 Imnaha-Snake Rivers 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 Imnaha-Snake Rivers 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 Imnaha-Snake Rivers 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 Imnaha-Snake Rivers Recovery Unit Team has identified essential research needs within the recovery unit.

General: The Snake River. A primary research need is a complete understanding of the current, and future, role that the Snake River should play in the recovery of bull trout. It is likely that fluvial bull trout life histories involved, at the very least, seasonal use of the mainstem Snake River. Bull trout have and do use the Snake River for part of their life history. It is essential to establish with greater certainty the current bull trout distribution and seasonal use areas within the Imnaha-Snake Rivers Recovery Unit. To this end, the recovery unit team recommends the development and application of a scientifically accepted, statistically rigorous, standardized protocol for determining the present distribution of bull trout. Application of such a protocol will improve the recovery team's ability to identify additional core areas, or revise the current classification. Specifically, tributaries from which there are isolated or anecdotal reports of bull trout using the mainstem of the Snake River should be targeted to

clarify bull trout distribution within the recovery unit. This includes, but is not limited to, the mainstem of the Imnaha River and Sheep Creek.

The Imnaha River flows into the Snake River between Lower Granite and Hells Canyon Dams. Both of these dams could be a barrier to bull trout as could the reservoir created by Lower Granite Dam. Although Lower Granite Dam has a ladder for passage of anadromous species, Hells Canyon Dam does not provide for fish passage. Hells Canyon Dam is an Idaho Power facility that is a terminal barrier to upstream movement. Whether bull trout are attempting to move upstream in the Snake River and are being blocked by Hells Canyon Dam needs to be further evaluated. Lower Granite Dam is part of the Federal Columbia River Power System. Incidental catch of bull trout at Federal Columbia River Power System facilities has only been recorded in the Fish Passage Center database since 1997. Prior to 1997, a bull trout sighting could have been noted as a "comment", but would not have been recorded in the database. Records prior to 1997 need to be examined for any documentation of bull trout in the comments. Passage facilities and reservoir operations at Lower Granite Dam need to be evaluated as to their suitability for bull trout.

General: Distribution and Abundance. The Imnaha-Snake Rivers Recovery Unit Team based estimates of recovered abundance levels and the number of local populations on the best available information and professional judgement. Information about historical abundance levels and distribution of spawning populations is very 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.

The Imnaha-Snake Rivers Recovery Unit Team has identified an urgent need for the development of a standardized monitoring and assessment program that would more accurately describe the 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. This recovery unit chapter is the first step in the planning process for bull trout recovery in the Imnaha-Snake Rivers 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. An important component in recovery implementation and the use of adaptive management will be the evaluation of recommended 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.

Specific Information Needs: Snake River. There are a number of research needs regarding habitat use and movements of bull trout. One such research need is data on the movement and seasonality of use of different habitat types in the mainstem Snake River by fluvial bull trout from the Imnaha River, Sheep Creek, and Granite Creek. For fluvial bull trout using the mainstem Snake River, the timing of use (arrival and departure), the habitat conditions in the mainstem associated with these movements, the manner in which fish use the mainstem (including the reservoir behind Lower Granite Dam), the frequency with which fish enter or leave the mainstem, and the fidelity that fish have to a particular tributary all need to be determined. These studies should be conducted in conjunction with studies on bull trout from adjacent recovery units, for example, Grande Ronde, Clearwater, etc. to determine areas of overlapping use and possible interactions. Additional information is needed on the distribution and abundance of bull trout in Sheep Creek, Little Sheep Creek, Granite Creek, and Lightning Creek as well as on the presence/absence of bull trout in other tributaries to the Snake River. Studies are also needed to determine the migration timing and pathways in and between tributaries within the Imnaha-Snake Rivers Recovery Unit.

As discussed in Chapter 1, a standardized, statistically sound bull trout population monitoring program should be designed and implemented. Methods should include techniques appropriate for monitoring the abundance of fluvial, resident, and mixed local populations. Periodic monitoring should include potential habitat (core habitat) where the status of bull trout is unknown or re-establishment is anticipated. Databases should be reviewed and updated with bull trout distribution records. A centralized database should be developed and maintained for all bull trout distribution and monitoring data. This activity needs to be supported directly and should include data from Tribal, State, and Federal activities.

Research should be conducted to determine life history characteristics of both local resident and migratory bull trout (including limiting factors). Studies should include an evaluation of population structure (life table) of existing local populations, determination of age- and size-specific fecundity and longevity of both resident and fluvial bull trout, and comparison of the characteristics of relatively strong and weak populations (*e.g.*, Big Sheep Creek and Little Sheep Creek). Research is also needed to determine the range of temperature tolerances for bull trout life stages in different habitats and the mechanism by which resident life forms undergo transition to migratory forms. The resulting data should be used to evaluate the adequacy of existing State water quality regulations. Additional data on the food habits of bull trout is needed to assess whether the prey base necessary for increased bull trout abundance is available. Specifically, the relationship between the prey base needed by bull trout and efforts to increase chinook and steelhead populations (particularly through hatchery supplementation) should be explored.

Another research need is to evaluate connectivity among local populations. This will include determining whether bull trout from McCully Creek, upper Big Sheep Creek, and the rest of the Imnaha Core Area need to be connected to achieve recovery. The consequences of genetic fragmentation/population isolation due to human-made barriers should also be evaluated (for example, low, warm water conditions in the lower portion of the

Imnaha River). Feasibility assessments should be conducted for establishing connectivity where it is required to achieve recovery criteria for the recovery unit.

Studies will be needed to assess progress and response of habitat/local populations to implementation of recovery tasks. The effectiveness of different active and passive habitat restoration techniques in restoring watershed function and local bull trout populations should be evaluated (*e.g.* grazing management projects on Big Sheep Creek).

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 Imnaha-Snake Rivers Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Imnaha-Snake Rivers Recovery Unit chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Imnaha-Snake Rivers 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 Imnaha-Snake Rivers 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 Identify sources of sediment delivery. Roads are a main source of sediment in the Imnaha-Snake Rivers Recovery Unit. Use existing Oregon Department of Transportation as well as proposed U.S. Forest Service road assessments to identify areas where action is necessary to correct problems associated with roads. Landslides are also a significant source. Use existing habitat surveys to identify problem areas and U.S. Forest Service regulatory processes to help correct the problem.

1.1.2 Assess effects on bull trout from nonpoint source pollution. Impacts to bull trout in terms of nutrients (*i.e.*, feedlots in Little Sheep Creek and winter feeding of livestock in valley bottoms) are unknown. At least in part, they could be determined through the Total Maximum Daily Load or SB1010 processes.

1.1.3 Conduct a trail assessment in the Sheep Creek and Granite Creek watersheds. Both watersheds have an extensive trail system. Recreational use of the upper elevations of the watershed are limited to summer and fall. The goal is to assess the contribution of the trail systems in each watershed to erosion and sediment delivery to streams. Specific areas in need of maintenance and repair should be identified and prioritized.

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

1.2.1 Assess the feasibility of installing appropriate fish passage structures around diversions or removing related migration barriers. Diversions considered migration barriers include the Wallowa Valley Improvement Canal diversions on Big Sheep Creek, Little Sheep Creek, and McCully Creek.

1.2.2 Assess the feasibility of installing appropriate fish screening structures in the Wallowa Valley Improvement Canal. It may be appropriate to screen the canal so that bull trout remain in their natural stream of origin. However, during certain times of the year, it may be difficult to maintain screens that function properly.

1.2.3 Restore connectivity and opportunities for migration. At least in part, this could be accomplished by restoring instream flows in McCully Creek, Little Sheep Creek, and Big Sheep Creek. To accomplish this, explore options such as purchasing or leasing water rights.

1.2.4 Assess whether hatchery weirs are impacting bull trout. Hatchery weirs in the Imnaha River (Oregon Department of Fish and Wildlife) acting as passage barriers may be influencing the spawning distribution and spawning time of bull trout. This potential impact should be evaluated.

1.2.5 Assess whether hatchery intakes are impacting bull trout. Assess the impacts to bull trout of operating hatchery intakes at Oregon Department of Fish and Wildlife's Imnaha Satellite Facility. Insure that these intakes are screened properly.

1.2.6 Salvage stranded bull trout. In areas where fish become stranded because of low water conditions (*i.e.*, the Wallowa Valley Improvement Canal), conduct salvage operations.

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

1.3.1 Restore riparian zones associated with bull trout habitat. Revegetate to restore shade and canopy, riparian cover, and native vegetation, for example, in Big Sheep Creek from Coyote to Owl Creek as well as in upper Little Sheep Creek and its tributaries.

1.3.2. Maintain riparian zones associated with bull trout habitat. Manage streams (*i.e.*, Big Sheep Creek) in a manner designed to maintain existing riparian growth and function.

1.3.3. Reduce grazing impacts. Management alternatives exist (*e.g.*, fencing, changes in timing and use of riparian pastures, off site watering and salting) which have been proven to reduce grazing impacts. These should be used in (for example) Big Sheep Creek from Coyote to Owl Creek.

1.3.4. Assess the need for stream channel restoration activities. Potential bull trout habitat on National Forest lands and on private lands needs to be assessed. For example, assess restoring the channel at the spillway on the canal and the upper Little Sheep Creek road crossing.

1.3.5. Maintain long-term wood recruitment in the Imnaha River subbasin.

1.3.6 Conserve existing high quality bull trout habitat in Sheep Creek, Granite Creek, and the Snake River. The conservation of existing habitat, spawning, and early rearing as well as sub-adult and adult rearing habitat, along with the current bull trout populations in these areas, is essential to avoid further loss of, or increased risk to, the

species. All available scientific, land management, and political means should be used to assess and manage human actions in these areas to assure conservation of the existing high quality habitat and the populations of bull trout.

1.3.7 Conduct a stream assessment in Sheep and Granite Creeks. The goals are to evaluate stream conditions and to develop and apply basin management plans, if needed, based upon the current condition of the streams. Most measures should be aimed at determining the quality of fish habitat with an additional component of fish surveying. Problems should be identified and prioritized.

1.3.8 Protect, maintain, and enhance anadromous fish habitats to increase available forage species for bull trout. Anadromous fish historically provided abundant forage to bull trout. Steelhead and chinook salmon have drastically declined from historical levels and the current limited availability of these prey may be limiting bull trout distribution and abundance. Increasing abundance of anadromous fish will provide a greater prey base to bull trout. Bull trout may use accessible fish bearing tributaries as foraging habitat, particularly in fall, winter, and spring, when water temperatures are cooler. Activities to improve anadromous fish habitats in watersheds with mixed ownership may require coordinated watershed management plans and acquisition of conservation easements for private land enhancement/protection measures.

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

1.4.1. Evaluate the impacts of Lower Granite Dam and Hells Canyon Dam. Bull trout from the Imnaha-Snake Rivers Recovery Unit enter the mainstem of the Snake River. However, how bull trout use the mainstem of the Snake River and whether they attempt to pass either dam has not been determined, and impacts of hydropower facility operation have not been well defined.

1.4.2. Review reservoir operations. The impacts to bull trout from various aspects of reservoir operations, including but not limited to, water level manipulation, physical entrainment, and gas entrainment need to be thoroughly explored. As a result of these reviews, operational recommendations should be provided through the Federal Energy Regulatory Commission, State relicensing processes, and Federal consultations. For examples, assess operations of Lower Granite Dam and the Hells Canyon Complex.

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

1.5.1 Assess current risk of catastrophic fire to bull trout populations. Vulnerable areas include Lick Creek and Big Sheep Creek.

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.

2.2.1 Evaluate enforcement of fish stocking regulations. Improve enforcement of laws governing illegal transport and introduction of live fish. For example, in Oregon illegal transport of live fish is a priority for the Coordinated Enforcement Program. Develop standard and effective procedures for responding to illegal introductions of nonnative fishes throughout the States of Oregon, Idaho and Washington, particularly in the Snake River.

2.3 Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.3.1 Provide information to the public. Implement an educational effort about the problems and consequences of unauthorized fish introductions.

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 Assess the interactions between bull trout and introduced fishes. Determine site-specific levels of competition and hybridization of bull trout with introduced fish and assess impacts of those interactions; especially lake trout, rainbow trout, brook trout, brown trout, northern pike, largemouth and smallmouth bass, and walleye.

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

2.6.1 Implement management actions to reduce the distribution and abundance of nonnative species where bull trout will benefit.

2.6.2 Investigate feasibility of screening the outlet at Twin Lakes. This would help reduce the risk of brook trout entering the Imnaha River during high water years.

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 Coordinate plans associated with fish management. Incorporate bull trout recovery actions and adaptively integrate research results into The Oregon Plan for Salmon and Watersheds, Idaho Native 5-Year Plan, the Northwest Power Planning Council's subbasin plans, Federal land management plans, the Wallowa County and Nez Perce Multi-Species Plan, local watershed council action plans, and other relevant fish and habitat management plans. Request assistance with implementation of recovery strategies for bull trout through all relevant plans.

3.1.2 Coordinate recovery efforts on bull trout, salmon and steelhead. Coordinate bull trout recovery with recovery efforts being developed for other listed species (*e.g.*, Snake River Spring/Summer chinook salmon). Implement recovery plans for other listed species.

3.1.3 Evaluate and improve fisheries management guidelines and policies designed to protect native species. Examples include the U.S. Forest Service's and Bureau of Land

Management's, Land and Resource Management Plans and associated aquatic conservation strategy (PACFISH/INFISH), and Oregon Department of Fish and Wildlife's Native Fish Conservation Policy.

3.1.4 Emphasize and support compliance with management plans that improve Snake River anadromous fish smolt:adult return ratios or fish production for the upper Snake River Basin. Anadromous fish historically provided abundant forage to bull trout. Steelhead and chinook salmon have drastically declined from historical levels and the current limited availability of these prey may be limiting bull trout distribution and abundance. Increasing abundance of anadromous fish will provide a greater prey base to bull trout.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

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.*

3.4 *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.*

4.2 *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.*

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

5.2.1 Conduct watershed assessments. Evaluate historical and present conditions in each habitat type by watershed.

5.2.2 Determine the range of temperature tolerances for bull trout life stages in different habitats. Use the results of ongoing temperature studies to address the adequacy of existing regulations. The recovery unit team identified this as a need range-wide.

5.2.3 Determine the seasonal movement patterns of adult and sub-adult migratory bull trout. This action would include bull trout which use different habitat types, including the mainstem Snake River. This information is necessary to determine how bull trout from the Imnaha-Snake Rivers Recovery Unit are related to each other as well as other bull trout populations in Snake River watersheds.

5.2.4 Evaluate food web interactions. This action is particularly relevant in drainages most affected by introduced fishes

and reservoir operations. For example, the mainstem of the Snake River and the lower Imnaha River.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past Basin Management Plans 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.

5.4.1 Maintain fish health screening and transplant protocols. This will help reduce risk of disease transmission. Include discussion of fish health in the terms and conditions in permits for hatchery operations for guidance.

5.4.2 Provide information to the public. Produce a whirling disease informational pamphlet for public distribution. This should contain current information of this parasites distribution in Oregon and Washington and list precautions that should be taken by the fishing public to help prevent its spread to other watersheds.

5.4.3 Monitor for effects of fish pathogens on Oregon bull trout populations. Follow Oregon Department of Fish and Wildlife protocols (in development) for handling and disposition of bull trout mortalities, for example, submission to Oregon Department of Fish and Wildlife fish pathology laboratories for disease assessment.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 Determine life history requirements. Local resident and migratory bull trout populations both exist in the recovery unit and may have different requirements.

5.5.2. Investigate the relationship between bull trout and anadromous species. This relationship is particularly important relative to predator-prey interactions. Evaluate the dependence of bull trout on anadromous prey.

5.5.3. Continue to survey for bull trout. Periodically monitor for bull trout in potential habitat where their status is unknown or recolonization is anticipated.

5.5.4 Compare weak and strong populations. The characteristics of relatively strong (*e.g.*, abundant, well distributed) and relatively weak but otherwise similar populations (for example, the McCully Creek and Little Sheep Creek populations) may be very different. This information is necessary to understand the factors limiting bull trout populations.

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

5.6.1 Determine the consequences of genetic fragmentation and isolation. This isolation may be due to human-made or natural barriers (*e.g.*, the Wallowa Valley Improvement Canal). The recovery unit team identified this as a need range-wide.

5.6.2 Investigate use of the mainstem Snake River by bull trout from all three core areas. It is essential to understand how important this area is in the life history of bull trout from

this recovery unit. This should be done in conjunction with studies on bull trout from adjacent recovery units (*e.g.*, Grande Ronde, and Clearwater) to determine areas of overlapping use and possible interactions.

5.6.3 Evaluate the population structure of bull trout in the recovery unit. Assess whether the recovery unit consists of one large population or multiple populations and whether there appears to be any metapopulation structuring. This information would be used to assess, and refine if needed, the current local population designations.

5.6.4 Evaluate basic life history characteristics. Determine the age- and size- specific fecundity of fluvial and resident bull trout. For both fluvial and resident bull trout, determine the age at first spawning, size at first spawning, longevity, and the number of spawns during a life time.

5.6.5 Evaluate survival rates. Determine the embryo to fry, fry to age 'X', and age 'X' to first spawn survival rates as well as parent to progeny ratios. Generate a life table. Identify which life stages have the greatest mortality and what factors may be associated with that mortality.

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. This may be accomplished through conservation easements, management plans, purchase from willing sellers, and land exchanges or other means. Specifically, explore whether

these opportunities exist in the Big Sheep and Little Sheep creek watersheds.

6.1.2 Work cooperatively with neighboring States and governments. Many of these watersheds span interstate and tribal boundaries. Cooperation will be necessary to implement recovery actions.

6.1.3 Provide information to the public. Develop educational materials on bull trout and their habitat needs, for example, watershed form and function, riparian and side channel restoration, and large wood placement.

6.2 *Enforce existing Federal and State 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 generate progress reports on implementation of the recovery plan for the U.S. Fish and Wildlife Service.

7.1.1 Develop a participation plan to support implementation in the recovery unit. Consider a combined coordination meeting for the Grande Ronde and Imnaha-Snake Rivers Recovery Units. Share results and data, check progress toward recovery, and coordinate work for coming field season.

7.2 *Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts (coordinate with 5.1).*

7.3 Revise strategy for recovery as suggested by new information.