Snake Hells Canyon Subbasin Management Plan

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Prepared for the Northwest Power and Conservation Council

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Table 1. Acronyms used in the *Snake Hells Canyon Subbasin Management Plan*.

Acronym	Definition
Agencies or Groups	
BLM	U.S. Bureau of Land Management
BPA	Bonneville Power Administration (Bonneville)
CBFWA	Columbia Basin Fish and Wildlife Authority
NPCC or Council	Northwest Power and Conservation Council
FERC	Federal Energy Regulatory Commission
IDFG	Idaho Department of Fish and Game
IPC	Idaho Power Company
ISDA	Idaho State Department of Agriculture
ISRP	Independent Scientific Review Panel
NOAA Fisheries	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northwest Power and Conservation Council (formerly the Northwest Power Planning Council or NPPC)
NRCS	Natural Resources Conservation Service
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
Terms	
APRE	Artificial Production Review and Evaluation
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
CCRP	Continuous Conservation Reserve Program (FSA)
CRFMP	Columbia River Fish Management Plan
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program (FSA)
CSMEP	Collaborative Systemwide Monitoring and Evaluation Project
CWA	Clean Water Act
EAWS	ecosystem analysis at the watershed scale
ESA	Endangered Species Act
FCRPS	Federal Columbia River Power System
FSA	Farm Service Agency
GAP	Gap Analysis Program
GIS	geographic information systems
HGMP	hatchery and genetic management plan
HCNRA	Hells Canyon National Recreation Area
HRV	historic range of variability
HUC	hydrologic unit code
KEC	key environmental correlate
KEF	key ecological function

Acronym	Definition
QHA	Qualitative Habitat Assessment
RM&E	research, monitoring, and evaluation
SAR	smolt-to-adult return
TMDL	total maximum daily load
WHIP	Wildlife Habitat Incentives Program
WHT	wildlife habitat type

1 Introduction

The *Snake Hells Canyon Subbasin Plan* was produced as part of the Northwest Power and Conservation Council's (NPCC, formerly the Northwest Power Planning Council or NPPC) Fish and Wildlife Program. This plan will help direct Bonneville Power Administration's (BPA) funding of projects that mitigate for damage to fish and wildlife caused by the development and operations of the Columbia River's hydropower system. This subbasin plan was developed in an open public process that included the participation of a wide range of state, federal, local, and tribal governments; landowners; and other stakeholders. The NPCC hopes that this process directs funding to fish and wildlife projects that will provide the most benefit to the subbasin.

An adopted subbasin plan is intended to be a living document that increases analytical, predictive, and prescriptive ability to restore fish and wildlife in a subbasin. The *Snake Hells Canyon Subbasin Plan* will be updated every three years to include new information that will guide revision of the biological objectives, strategies, and implementation plan. The NPCC views plan development as an ongoing process of refinement of the region's efforts through adaptive management. More information about subbasin planning can be found at www.nwcouncil.org.

The *Snake Hells Canyon Subbasin Plan* includes three interrelated volumes that describe the characteristics, management, and vision for the future of the Snake Hells Canyon subbasin.

Assessment (Volume 1)—The *Snake Hells Canyon Subbasin Assessment* examines the biological potential of the Snake Hells Canyon subbasin to support key habitats and species, as well as factors limiting this potential. These limiting factors provide opportunity for restoration. The assessment describes existing and historic resources and conditions within the subbasin, focal species and habitats, environmental conditions, out-of-subbasin impacts, ecological relationships, and limiting factors, and it provides a final synthesis and interpretation. Aquatic and Terrestrial Technical Teams guided the development of the assessment and technical portions of the management plan. The Technical Teams were composed of scientific experts with the biological, physical, and management expertise to refine, validate, and analyze data used to inform the planning process.

Inventory (Volume 2)—The *Snake Hells Canyon Subbasin Inventory* summarizes fish and wildlife protection, restoration, and artificial production activities and programs within the Snake Hells Canyon subbasin that have occurred over the last five years or are about to be implemented. The information includes programs and projects, as well as locally developed regulations and ordinances, that protect fish, wildlife, and habitat.

Management Plan (Volume 3)—The *Snake Hells Canyon Subbasin Management Plan* defines a vision for the future of the subbasin, including biological goals and strategies for the next 10 to 15 years. The management plan includes a research, monitoring, and evaluation plan to ensure that implemented strategies succeed in addressing limiting factors and to reduce uncertainties and data gaps. The management plan also includes information about the relationship between proposed activities and the Endangered Species Act (ESA) and Clean Water Act (CWA). The Planning Team, composed of representatives from government agencies with jurisdictional

authority and other stakeholders in the subbasin, was formed to guide development of the management plan.

1.1 Entities and Authorities for Resource Management

Multiple agencies and entities are involved in managing and protecting fish and wildlife populations and their habitats in the Snake Hells Canyon subbasin. Federal, state, and local regulations, plans, policies, initiatives, and guidelines are part of this effort. The Nez Perce Tribe, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, and Idaho Department of Fish and Game (IDFG) share co-management authority over the fisheries resource. Federal involvement in this arena stems from ESA responsibilities and management responsibilities for federal lands, most notably the Hells Canyon National Recreation Area (HCNRA). Numerous federal, state, and local land managers are responsible for multipurpose land and water use management, including the protection and restoration of fish and wildlife habitat. Management entities contractually involved in developing the *Snake Hells Canyon Subbasin Plan* are outlined below.

1.1.1 Nez Perce Tribe

The Nez Perce Tribe serves as lead entity for subbasin planning for the Snake Hells Canyon subbasin. The tribe contracted with the NPCC to develop the *Snake Hells Canyon Subbasin Plan* and ensured that opportunities occurred for participation by fish and wildlife managers, local interests, and other key stakeholders, including tribal and local governments.

The Nez Perce Tribe is responsible for managing, protecting, and enhancing treaty fish and wildlife resources and habitats for present and future generations. Tribal government headquarters are located in the Clearwater River subbasin in Lapwai, Idaho, with offices in Kamiah and Orofino, Idaho. The Nez Perce Tribe has treaty-reserved fishing, hunting, and gathering rights pursuant to the 1855 treaty with the United States. Fish and wildlife activities relate to all aspects of management, including recovery, restoration, mitigation, enforcement, and resident fish programs.

1.1.2 Northwest Power and Conservation Council

The NPCC has the responsibility to develop and periodically revise the Fish and Wildlife Program for the Columbia Basin (NPPC 2000). In the 2000 revision, the NPCC (then NPPC) proposed that 62 locally developed subbasin plans, as well as plans for the mainstem Columbia and Snake rivers, be adopted into its Fish and Wildlife Program. The NPCC administered subbasin planning contracts pursuant to requirements in its Master Contract with the BPA (NPCC 2003). The NPCC will be responsible for reviewing and adopting each subbasin plan and for ensuring that plans are consistent with the vision, biological objectives, and strategies adopted at the Columbia Basin and province levels.

1.1.3 Bonneville Power Administration

The BPA is a federal agency established to market power produced by the federal dams in the Columbia Basin. As a result of the Northwest Power Act of 1980, the BPA is required to allocate a portion of power revenues to mitigate for damage caused to fish and wildlife populations and habitat from construction and operation of the hydropower system.

1.1.4 Project Team

The Nez Perce Tribe subcontracted with Ecovista to facilitate the planning process and write plan documents (Table 2). Employees of Ecovista and the Idaho Council on Industry and the Environment are not members of the Technical or Planning Teams. However, Ecovista staff facilitated meetings and participated so that Ecovista could accurately represent decisions made at technical and/or planning meetings.

Table 2. Members, affiliation, and roles of people on the Project Team for the Snake Hells Canyon subbasin.

Name	Affiliation	Role
Darin Saul	Ecovista	project coordinator, technical writer, and editor
Tom Cichosz	Ecovista	fisheries biologist, technical writer
Anne Davidson	Ecovista	wildlife biologist, GIS, technical writer
Amy Owen	Ecovista	planner, technical writer
Pat Barclay	ICIE	public involvement coordination
Angela Sondenaa	Nez Perce Tribe	botanist, wildlife biologist, technical writer
Felix McGowen	Nez Perce Tribe	Nez Perce Tribe project coordinator

1.1.5 Planning Team

The Snake Hells Canyon subbasin Planning Team includes representatives from government agencies with jurisdictional authority in the subbasin, fish and wildlife managers, industry and user-group representatives, and private landowners (Table 3). The Planning Team guided the public involvement process, developed the vision statement, helped develop and review the social economic objectives, developed final recommendations, and participated in prioritizing subbasin strategies. Regular communication and input among team members occurred throughout the planning process. The Planning Team met monthly throughout the project period. People listed in Table 3 were directly involved on the Planning Team or requested to receive communications and be allowed to provide input on Planning Team documents.

Table 3. Affiliation and contact information for members of the Planning Team for the Snake Hells Canyon subbasin.

Name	Affiliation	E-mail Address
Brad Johnson	Asotin County Conservation District	brad-johnson@wa.nacdnet.org
Craig Johnson	Bureau of Land Management	craig_johnson@blm.gov
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George Enneking	Idaho County Commissioner	genneking@idahocounty.org
Craig Shepard	Idaho Department of Environmental Quality	cshepard@deq.state.id.us
Nathan Brindza	Idaho Department of Fish and Game	nbrindza@idfg.state.id.us
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Brad Smith	Oregon Department of Fish and Wildlife	gofish@oregontrail.net
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Art Talsma	The Nature Conservancy	atalsma@tnc.org
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Scott Springer	U.S. Forest Service	sspringer@fs.fed.us
Chad Atkins	Washington Department of Ecology	catk461@ecy.wa.gov

1.1.6 Technical Team

The Aquatic and Terrestrial Technical Teams included scientific experts who guided the development of the subbasin assessment and plan. These teams had the biological, physical, and management expertise to refine, validate, and analyze data used to inform the planning process. The Technical Team developed the biological objectives, strategies and research, monitoring and evaluation sections of the plan, as well as reviewed all project documents. The Technical Teams for the Snake Hells Canyon subbasin met monthly or bimonthly throughout the process and participated in one- or multiday workshops focused on developing assessment and plan components and filling data gaps. Individuals listed in Table 4 were directly involved on the Technical Teams or requested to receive communications and be allowed to provide input on documents.

Table 4. Affiliation and contact information for members of the Technical Teams for the Snake Hells Canyon subbasin.

Name	Affiliation	E-mail Address
Craig Johnson	Bureau of Land Management	craig_johnson@blm.gov
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1.2 Public Outreach and Government Involvement

As the *Snake Hells Canyon Subbasin Management Plan* was developed, four methods of outreach and participation from the public and governments involved in the Snake Hells Canyon subbasin were utilized: Technical Team meetings, Planning Team meetings, public meetings, and a website.

1.2.1 Technical Team Participation

The Technical Teams met on the third Thursday of every month at the Brammer Addition Building or State Building conference room in Lewiston, Idaho, and the meetings were open to the public. This information was posted on the Ecovista website and provided at public meetings. The Technical Teams reviewed and gave input on the technical aspects of the subbasin assessment and plan.

1.2.2 Planning Team Participation

The Planning Team was composed of members with expertise and knowledge of the management of natural resources and socioeconomic issues in the Snake Hells Canyon subbasin. The meetings were held on the third Thursday of every month at the Brammer Addition Building or State Building conference room in Lewiston, Idaho, and were open to the public. This information was posted on the Ecovista website and provided at public meetings. The Planning Team reviewed and guided development of management aspects of the subbasin plan, which is documented in the subbasin management plan.

1.2.3 Public Meeting Outreach

Two public meetings were held in order to introduce the subbasin plan and provide an opportunity for input from local people and resource managers. Pat Barclay of the Idaho Council on Industry and the Environment coordinated public meeting announcements and logistics for the Snake Hells Canyon subbasin.

Public Meeting #1: The purpose of the first public meeting was to introduce subbasin planning to locals who live, work, and utilize land for various purposes within the subbasin and solicit comments and opinions on the subbasin plan. The results from the meeting were taken to the Planning Team and considered in management plan development.

The first public meeting was held in Lewiston on November 4, 2004. It was well publicized and had 20 attendees, not including the Project and Planning Team members. A discussion followed a short PowerPoint presentation outlining the planning process. Concerns were raised in three areas:

1. The potential for increased regulation to land and business owners in the area.

2. The use of the planning process to further land use agendas and gain funding.

3. The relationship to the Federal Energy Regulatory Commission's relicensing process.

Ira Jones and Felix McGowen of Nez Perce Tribe assisted in answering questions and helping to alleviate concerns. They stressed that the subbasin planning process is a voluntary process geared toward providing funding to projects that would help mitigate some of the effects from hydropower. It was also explained that this is not a regulatory process in itself, nor is it intended to increase hardship among land and business owners.

Public Meeting #2: The purpose of the second public meeting was to present the *Snake Hells Canyon Subbasin Plan* (assessment, management plan, and inventory) and solicit comments and ideas from local land and natural resource users. The comments were documented and presented to the Planning Team for incorporation into the draft subbasin plan.

The second public meeting was held in Lewiston on March 18, 2004. The meeting was poorly attended, but did provide an opportunity to inform a legislative staff person about the process.

1.2.4 Ecovista Website Information

As the *Snake Hells Canyon Subbasin Plan* was developed, draft documents, information on meetings, and information about subbasin planning were posted on the Ecovista website starting in November of 2003 (www.ecovista.ws). Updated drafts and other items were posted on the website throughout the process.

1.3 Review Process

The Snake Hells Canyon Subbasin Assessment, Inventory and Management Plan were disseminated for review throughout the development phase via e-mail lists compiled by the Project Team and through posting on the Ecovista website. The assessment was posted for review in November 2003 and January, March, April, and May 2004. Documents were posted on the Ecovista website (www.ecovista.ws) and presented at Planning and Technical Team meetings. In addition, the assessment and preliminary outcomes of the plan were presented at the second round of public meetings. Through this review process, representatives of local, state, tribal, and federal governments, as well as landowners and other stakeholders in the subbasin, were given an opportunity to interact with project staff as they reviewed and offered comments on the subbasin planning effort.

The summer schedule for the independent scientific review of subbasin plans has been developed. For a majority of the subbasin plans, the ISRP/ISAB review process will begin immediately following the May 28 deadline and conclude with submittal of final reports to the Council by August 12, 2004. The Snake Hells Canyon Subbasin Plan will be reviewed during Week 7: July 19th-July 23rd (NPCC 2004).

To complete the review, about ten review teams, and one basin-wide umbrella committee have been established. The review teams are organized to review sets of subbasin plans grouped by

province. Each team consists of six or more reviewers and includes a mix of ISRP, ISAB, and Peer Review Group members. The umbrella group will help ensure a consistent level of review scrutiny and comment quality (NPCC 2004).

A review checklist and comment template is being developed for the ISRP/ISAB review of subbasin plans based on the Council's Subbasin Planning Technical Guide and will include the Council's review questions. Reviewers must evaluate: 1) whether the subbasin plans are complete, scientifically sound, and internally consistent following a transparent and defensible logic path; and 2) whether the subbasin plans are externally consistent with the vision, principles, objectives, and strategies contained in the Council's 2000 Fish and Wildlife Program. The checklist also asks reviewers to evaluate whether the plan satisfactorily provides the assessment, inventory and management elements requested by the Council and, to recommend the level of need to further treat a specific element of the subbasin plan before the plan meets the criteria of completeness, scientific soundness, and transparency. A sample of the checklist and template will be available in March (NPCC 2004).

Subbasin Plan Adoptability Framework
The Council's Legal Division is organizing a framework that the Council members may use to make the determinations required by the Power Act relative to subbasin plan amendment recommendations. The framework is essentially a way of organizing the review around the Act's standards that apply to program amendments for the Fish and Wildlife Program measures found in section 4(h), and the standards set in the 2000 Fish and Wildlife Program in the unique context of subbasin plans. The framework will be discussed with Council members in the near future.

2 Overview of the Subbasin Assessment

The *Snake Hells Canyon Subbasin Assessment* is provided under separate cover. The assessment represents a combined effort of local resource managers and specialists from multiple disciplines and agencies over three years, and it lays the foundation for the management plan contained within this volume. The assessment provides the technical information, interpretation, and synthesis on which the vision and goal statements, as well as the hypotheses, objectives, and strategies developed in this document, are based. The assessment has four major components.

- Subbasin Description—Section 1 describes the physical features of the subbasin including the climate, geology, topography, and hydrology. It also discusses land uses, water uses, and demographics of the subbasin. Section 2 provides a regional context for the subbasin.

- Species Characterization and Status—Section 3 identifies aquatic and terrestrial species of ecological importance and identifies focal species for the subbasin. Major habitat types important to focal species are described.

- Identification of Limiting Factors—Section 4 describes factors limiting, and in some cases threatening, the persistence of focal, threatened and endangered, and culturally important wildlife species.

3 Overview of the Subbasin Inventory

The *Snake Hells Canyon Subbasin Inventory* is provided under separate cover as Volume 2 and presents information on existing activities, projects, and programs underway in the subbasin. The inventory consists of five major divisions:

- Existing Protection—Section 2 describes agency project funding programs and existing policies affecting resource management.

- Management Plans—Section 3 presented here highlights some of the most recent or relevant plans guiding land and resource management in the Snake Hells Canyon subbasin.

- Management Programs—Section 4 describes plans that have information focused on a finer-scale watershed level than those described in Section 3 and that are more closely related to project development. Three primary types of documents are listed: watershed-scale assessments, watershed-scale plans, and TMDLs.

- Conservation and Restoration Projects—Section 5 inventories existing biological assessments, surveys, and projects in the subbasin.

- GAP Analysis—Section 6 identifies objectives and strategies that need new or additional project and funding support.

4 Vision for the Snake Hells Canyon Subbasin

This vision and guiding principles for the *Snake Hells Canyon Subbasin Management Plan* were developed by the Planning Team during the summer and fall of 2003. The vision was developed to present a common goal and desirable future for the subbasin. The guiding principles are components of the vision that provide context and clarification of the vision. These principles are not listed in order of their ranking and are meant to be understood as interconnected and all of importance.

4.1 Vision Statement

The vision for the Snake Hells Canyon subbasin is a healthy ecosystem, with abundant, productive, and diverse aquatic and terrestrial species and habitats. This vision includes providing for healthy human economies, recreation, and cultures.

4.1.1 Guiding Principles

- Respect, recognize, and honor the legal authority, jurisdiction, treaty-reserved rights, and all legal rights of all parties.

- Protect, enhance, and restore habitats in a way that will recover and sustain aquatic and terrestrial species diversity with emphasis on the recovery of species listed under the Endangered Species Act and other native species. These actions should result in ridgetop-to-ridgetop stewardship of natural resources, recognizing all components of the ecosystem, including the human component.

- Evaluate economic impacts and potentials to provide opportunities for sustainable natural resource-based activities while sustaining aquatic and terrestrial species.

- Promote and enhance local participation in, and contribution to, natural resource problem solving and subbasinwide conservation efforts, to enhance understanding and appreciation of the need to protect, enhance, and restore a healthy and properly function ecosystem.

- Develop a scientific foundation for prioritizing projects and for monitoring and evaluation to increase effectiveness and credibility of management efforts in the subbasin.

- Modify as needed, the subbasin plan, to integrate new information.

- Enhance species populations to a level of healthy and harvestable abundance to support tribal treaty and public harvest goals

- Recognize and preserve areas with high aesthetic and/or cultural resource values.

4.2 Definitions and Qualifications

Definitions were developed and adopted by the Planning Team to ensure that the meaning of the vision and guiding principles would be clear to the many parties reading and applying them.

Words and phrases within the vision and guiding principles that may have more than one interpretation are defined here.

- Ecosystem—An ecological community of various plants, animals, humans, and other organisms, interacting with each other and with the nonliving resources in their environment, all functioning as a unit.

- Healthy Ecosystem—A community of predominantly native organisms interacting with each other and their physical environment that would persist through time.

- Enhance—To further improve the quality and value of the identified resource.

- Restore—To return the named resource to a close approximation of natural function and processes.

- Scientific Foundation—Relies upon the best available scientific knowledge. Describes the best understanding of biological realities that will govern how the vision is accomplished.

- Stewardship—Management of natural resources that conserves them for future generations.

- Sustainable—Conserving an ecological balance by avoiding depletion of natural resources. In terms of development, meeting economic objectives in ways that do not degrade the underlying environmental support system.

- Treaty Reserved Rights—A right is guaranteed and ratified by law under the treaty specific to the area. Each treaty is specific to individual tribes in the area. A right is a function such as gathering or fishing within the defined area.

5 Problem Statements, Objectives, and Strategies

The various components (problem statements, biological objectives, and strategies) of the *Snake Hells Canyon Subbasin Management Plan* described in this section have been developed from information presented in the Snake Hells Canyon subbasin assessment and inventory. References to information contained in other volumes of the subbasin plan, or sections in the management plan, are provided where applicable to aid readers in finding more detailed information regarding particular problem statements, objectives, and strategies.

The assessment lists the aquatic focal species (section 3.4) and limiting factors (section 4.1) and the terrestrial focal habitats and species (section 3.5) and limiting factors (section 4.2). Although the problem statements, objectives, and strategies are commonly related to individual species or communities, none of these ecosystem components function independently. Any actions that benefit or harm one species within the subbasin will also impact other species (aquatic or terrestrial, including humans) that rely on that species. In addition, every action will have social, political, and economic implications that must be addressed.

Social, economic, and political factors in the Snake Hells Canyon subbasin are important considerations in determining the success of the implementation phase of this management plan. These factors are referenced in the vision and guiding principles for the Snake Hells Canyon subbasin and must be considered at all levels of the planning process, including the development of appropriate problem statements, objectives, and strategies. Accounting for the human component of the subbasin will increase the probability that this plan will be successfully implemented and viewed as a necessary, socially acceptable, and reasonable step in the protection and recovery of aquatic and terrestrial species in the subbasin.

5.1 Problem Statement Summary

The problem statement summary is technically called the *working hypothesis* in NPCC documents. Both are intended to provide a scientific basis for the development of biological objectives and strategies. In this plan, we follow the recommendation of the Independent Scientific Review Panel (ISRP) to state the hypotheses as problem statements (NPPC 2001). The problem statement draws from the scientific foundation that underlies the NPCC's Fish and Wildlife Program. The NPCC recognizes eight scientific principles (NPPC 2001, pg 15) that form the scientific foundation, and all actions taken to implement the program must be consistent with these principles. The following problem statement is based on information and findings presented in the subbasin assessment, thereby summarizing the available science for development of the management plan. The problem statement provides an explicit scientific rationale under which various component problem statements, objectives, and strategies are organized to provide a linkage between the science and strategies presented within this plan.

Ecosystems within the Snake Hells Canyon subbasin have been impacted by human activities both in and outside of the subbasin, most commonly with negative impacts to aquatic and terrestrial species. Many aquatic and terrestrial species are currently at risk within the subbasin and, without appropriate management, may be further compromised (see assessment section 3, for species discussions). Humans are themselves an ecosystem component, and this management plan relies on the ability of human and nonhuman components to interact and coexist.

Anadromous focal fish species in the Snake Hells Canyon subbasin are limited primarily by out-of-subbasin factors involving hydropower development, ocean productivity, predation, and harvest (see assessment section 4.1.1). Hydropower development increases mortality in Snake River stocks of spring/summer chinook and blocks access to important spawning and rearing habitat. Fluctuations of ocean productivity in combination with the hydropower system have caused severe declines in productivity and survival rates. Predation, especially within reservoirs, is a potential limiting factor to salmonid smolts. Out-of-subbasin harvest is also a potential limiting factor for wild chinook and steelhead stocks within the subbasin.

Resident and anadromous focal fish species are limited within the subbasin by hatcheries, upstream hydroelectric developments and water storage, habitat degradation on the mainstem Snake River and tributaries, harvest, predation and loss of prey base (see assessment section 4.1.2). Evolutionarily Significant Units of wild spring/summer and fall chinook are thought to be a greater risk of extinction due to competition with hatchery fish. Fall chinook and likely white sturgeon are limited by hydroelectric developments through inundation of preferred spawning and rearing habitats and through changes in flow and thermal regimes during migration. Isolation and habitat degradation on the mainstem are limiting bull trout. Degraded habitat quality and quantity in the tributaries limits spring/summer chinook, bull trout, redband trout and steelhead. Fall chinook may be limited by incidental harvest and through incidental harassment by boaters during certain life phases (e.g., during spawning). Predation may limit all anadromous fish, though fall chinook have been the focus of studies related to this factor. Bull trout and white sturgeon are thought to be limited by a loss of prey base due to declines in anadromous fish production in the subbasin.

The Qualitative Habitat Assessment Model (QHA) defines riparian condition, excess fine sediment and reduced channel stability as primary limiting factors for fish populations throughout most tributary habitats in the subbasin (see assessment section 4.1.4). Additional factors with localized impacts in some tributaries include alteration of high and low flows, channel form, high and low temperatures, and pollutants (cattle waste).

Water quality factors that likely limit Snake Hells Canyon subbasin aquatic focal species are temperature, sediment, and total dissolved gas (see assessment section 4.1.3). Both temperature and sediment were listed under section 303(d) of the CWA. Temperature exceeds state standards in the mainstem Snake above the confluence with the Clearwater River. Sediments are deficient in the Snake River below Hells Canyon Dam due to the trapping of suspended sediment and bedload, reducing the amount of substrate that is needed for riparian growth and reducing availability of some suitable habitats for fish. Total dissolved gas has been recommended for listing and may also have limiting effects on fish populations as recommended in the Snake River TMDL.

Terrestrial species within the Snake Hells Canyon subbasin have been impacted by the loss of native grasslands, riparian degradation, the loss of ponderosa pine habitat, introduced plant species, changes in disturbance regime and vegetative structure, habitat fragmentation, and nutrient flow reduction (see assessment section 4.2).

Integration of this plan with existing programs and initiatives (described in the subbasin inventory) will provide benefits beyond those associated with individual plans or programs. Coordinated federal, tribal, state, and local policies are essential to achieve the goals and

objectives of this management plan. Implementation of ecosystem restoration or protection strategies will have economic ramifications (positive or negative), which need to be considered along with the restoration objectives and strategies defined in this management plan. Table 5 lists problem statements and objectives that address factors that limit fish and wildlife species in the Snake Hells Canyon subbasin.

Table 5. Problem statements and objectives addressing factors limiting fish and wildlife species.

Problem Statement	Objective	Limiting Factor
Biological Components		
Aquatic		
1. Upstream factors: Operations of the Hells Canyon Dam and Complex negatively impact aquatic species downstream of the dam.	1A: Ameliorate negative impacts from operations of the Hells Canyon Dam and Complex.	Upstream of subbasin factors: Hells Canyon Dam and operations
2. Downstream factors: Consistent natural productivity is currently inadequate to meet restoration and harvest goals for spring and fall chinook, steelhead, and Pacific lamprey.	2A: Increase SARs of naturally produced spawning adults to at least 4 to 6% for spring chinook, 3% for fall chinook, and 4% for steelhead, as measured at Lower Granite Dam, to increase natural production and harvest of fish populations.	Downstream of subbasin factors: hydropower system impacts
3. Migratory and resident fish production is limited by habitat quantity, quality, and connectivity in portions of the subbasin.	3A: Increase migratory fish productivity and production, as well as life stage-specific survival, through in-subbasin habitat improvement.	In -subbasin habitat deficiencies
	3B: Evaluate needs and opportunities to increase native resident populations (redband and bull trout) throughout the subbasin. Implement appropriate actions to address defined needs and opportunities.	In-subbasin habitat deficiencies
Terrestrial		
4. Limited information on the composition, population trends, interspecies interactions, habitat requirements, and ecosystem processes of many of the wildlife and plant (terrestrial) communities of the Snake Hells Canyon subbasin limits the ability to effectively manage or conserve these species.	4A: Increase understanding of the composition, population trends, interspecies interactions, habitat requirements, ecosystem processes, and impacts of management activities on terrestrial communities of the Snake Hells Canyon subbasin.	Insufficient data on wildlife populations and habitats in the subbasin

Problem Statement	Objective	Limiting Factor
5. Changes in the presence or abundance of particular key environmental correlates (KECs) or other habitat elements have decreased the subbasin's ability to support certain wildlife species.	5A: Maintain and enhance populations of focal, sensitive, and threatened and endangered species in the subbasin.	Various terrestrial limiting factors
6. Hells Canyon Dam negatively impacts terrestrial species and habitats within the subbasin	6A: Mitigate the negative impacts of Hells Canyon Dam on terrestrial species and habitats.	Contributes to riparian degradation and nutrient reduction limiting factors
7. The grazing of livestock in the subbasin has negatively impacted populations of native wildlife and plants.	7A: Reduce conflicts between livestock and native wildlife and plant populations through the development of a comprehensive basinwide and site-specific grazing management plan for the subbasin.	Contributes to introduced species, degraded grassland habitats, and degraded riparian habitats
	7B: Eliminate domestic sheep and goat grazing within bighorn sheep habitat.	Disease
Environmental Components		
8. Water quantity and quality are key environmental factors that limit the production of native fish species and aquatic wildlife.	8A: Restore natural flow regime that supports and meets the life history needs of aquatic species in the subbasin.	Base flow
	8B: Provide temperature regimes that meet the life stage-specific needs of aquatic focal species.	Temperature
	8C: Reduce sediment and sedimentation in tributaries to levels that can support life history requirements of focal species.	Sediment
9. The introductions of noxious weeds and nonnative plant species into the Snake Hells Canyon subbasin have negatively impacted native terrestrial focal habitats and species.	9A: Protect the existing quality, quantity, and diversity of native plant communities providing habitat to native wildlife species by preventing the introduction of noxious weeds and invasive exotic plants into native habitats.	Invasive species and noxious weeds
	9B: Reduce the extent and density of established noxious weeds and invasive exotics.	
10. The loss and degradation of the grassland habitats of the subbasin have negatively impacted numerous native plant and animal species dependent on these habitats.	10A: Protect existing good condition grasslands. (See discussion section below for description of how the management agencies of the subbasin define this.)	Loss/degradation of grasslands

Problem Statement	Objective	Limiting Factor
	10B: Restore degraded grasslands to good condition. Increase the coverage of native perennials, including bluebunch wheatgrass and/or Idaho fescue.	
11. The loss or degradation of wetland and riparian habitats in the subbasin has negatively impacted the numerous wildlife species that utilize these habitats.	11A: Protect and restore riparian habitats.	Loss/degradation of riparian habitat
	11B: Protect all currently functioning wetland habitats (including seep, spring, and wet meadow and other wetland areas). Restore degraded wetland habitats that provide or have the potential to provide important fish and wildlife habitats.	
12. Reductions in the extent of mature ponderosa pine habitats in the subbasin have negatively impacted the numerous wildlife species that utilize these habitats.	12A: Protect mature ponderosa pine habitats.	Loss of ponderosa pine habitats
	12B: Use management practices to develop or restore ponderosa pine communities in areas where this species was historically present.	
13. Changes in the disturbance regime and resulting structural conditions (primarily due to fire suppression and timber harvest) of the forested habitats of the Snake Hells Canyon subbasin have negatively impacted native terrestrial species that depend on these habitat types.	13A: Restore the composition and structure of forests to within the historic range of variability.	Change in disturbance regime/vegetative structure
14. Road construction has altered the size, quality, distribution, and spatial relationships in and between habitat patches in the subbasin.	14A: Reduce the impact of the transportation system on wildlife and fish populations and habitats.	Roads and habitat fragmentation
15. The hydropower system has caused a nutrient deficit in the subbasin by restricting the flow and delivery of nutrients downstream and by reducing anadromous fish runs through and into the subbasin. This has negatively impacted the subbasin's wildlife and fish populations.	15A. Restore natural nutrient cycles or mitigate for damages to aquatic and terrestrial populations due to the loss of these nutrients.	Nutrient reduction
Socioeconomic Components		

Problem Statement	Objective	Limiting Factor
16. As reflected in the inventory, numerous agencies and entities are implementing programs and projects in the subbasin. A lack of local support and understanding can undermine long-term implementation success. Coordination and integration can be improved to benefit economic, social, cultural, and biological aspects of aquatic and terrestrial protection and restoration in the subbasin.	16A. Improve coordination of activities in the subbasin to promote stewardship of natural resources and increase long-term implementation success.	Insufficient coordination
17. The management of both public and private lands and water in the Snake Hells Canyon subbasin impacts surrounding communities and their economies.	17A. Consider benefits and negative impacts to surrounding communities, their economies, and fish and wildlife.	Impacts to local economies
18. Many important cultural uses of the Snake Hells Canyon subbasin are impacted by aquatic and terrestrial management. Indian tribes are continually losing opportunities to practice long-standing traditions that keep their cultures alive—traditions related to and contingent on responsible natural resource management. Non-Indian users also face difficulty in maintaining important cultural uses in the subbasin. Local industries that support these users suffer or benefit from impacts on these uses.	18A. Protect and foster both Indian and non-Indian cultural uses of natural resources in the Snake Hells Canyon subbasin.	Impacts to cultural resources

5.2 Problem Statements, Objectives, and Strategies

The following list of problem statements, associated objectives, and strategies are derived from the problem statement summary with added detail. The problem statements were developed from the factors limiting focal species and habitats in the subbasin and from conditions that inhibit natural ecological processes as described in the subbasin assessment. Objectives describe the physical and biological changes needed to achieve the vision, consistent with the scientific principles. Strategies provide specific steps necessary to accomplish the biological objectives.

Problem statements, objectives, and strategies are grouped for organizational purposes as biological, environmental, or socioeconomic, although the three groups are intrinsically linked. "Biological" problem statements, objectives, and strategies are generally directed toward fish and wildlife populations, life histories, and life stages when sufficient data exist. Problem statements, objectives, and strategies meant to directly address habitats are addressed as "environmental." The biological and environmental objectives were developed by the Project and Technical Teams, with support from the Planning Team. Socioeconomic objectives and strategies address the human values, cultures, and economies. These components are considered by the Planning Team as critical to successfully implementing the *Snake Hells Canyon Subbasin*

Management Plan. Recommendations for further data collection or prioritization were noted where data gaps limit the development of sound biological objectives and strategies. These information needs are further detailed in the section 6 (about research, monitoring, and evaluation) of this volume. Formatting of the problem statements, objectives, and strategies follows the guidance in the *Technical Guide for Subbasin Planners* (NPPC 2001).

5.2.1 Biological Components

5.2.1.1 Aquatic Ecosystem

Problem 1: Upstream factors: Operations of the Hells Canyon Dam and Complex negatively impact aquatic species downstream of the dam.

Objective 1A: Ameliorate negative impacts from operations of the Hells Canyon Dam and Complex.

Strategies:

1A1. Investigate creative measures to allow future modifications to operations. Identify and prioritize most effective measures.

1A2. Establish, via the Federal Energy Regulatory Commission's (FERC) relicensing process for Hells Canyon Dam or license amendments, requirements to modify operations to minimize impacts to all life stages of fish species using the Snake River within Hells Canyon. Monitor effectiveness of measures.

1A3. Monitor both the effects of limiting factors on populations and effects of restoration and management efforts aimed at minimizing impacts of limiting factors.

Discussion: The major impacts of upstream hydroelectric development are on those species that primarily use the mainstem Snake River for much of their life history, particularly fall chinook and white sturgeon. However, all focal aquatic species are impacted to some degree by upstream hydropower development, including the Hells Canyon Dam and Complex (which includes Brownlee and Oxbow dams).

Flow releases from the Hells Canyon Complex were determined to play a significant role in shaping flow and temperature regimes in the Snake River. Resultant changes to habitat, flow, and thermal regimes have affected spawn timing, spawning location, and outmigration success of fall chinook in the Snake Hells Canyon subbasin (see assessment section 4.1.2).

Hydroelectric projects have also isolated white sturgeon and bull trout populations within the Snake Hells Canyon subbasin by restricting their movements into or out of the reach. Limited connectivity due to dams may limit persistence or productivity of these species within the Snake Hells Canyon subbasin. In

addition, the influence of upstream impoundments on flows, thermal regimes, and nutrient levels may limit spawning and incubation success of white sturgeon.

Problem 2: Downstream factors: Consistent natural productivity is currently inadequate to meet restoration and harvest goals for spring and fall chinook, steelhead, and Pacific lamprey.

Objective 2A: Increase SARs of naturally produced spawning adults to at least 4 to 6% for spring chinook, 3% for fall chinook, and 4% for steelhead, as measured at Lower Granite Dam, to increase natural production and harvest of fish populations[1].

Strategies:

2A1. Provide funding to ensure continued local agency participation in province- and basinwide coordinated studies and water management forums designed to examine mainstem and ocean mortality associated with differential migration timing and life histories of migratory fish species.

2A2. Utilize existing forums to enhance communication and coordination.

2A3. Conduct research within the context of identifying and prioritizing management versus basinwide environmental effects.

2A4. Continue to develop stock-specific knowledge of interactions between hatchery and wild fish.

2A5. Conduct research on Pacific lamprey life history, abundance/distribution, and productivity within the subbasin.

2A6. Prioritize limiting factors and actions to address limiting factors using information presented in section 8.1. Integrate priorities and actions with those outlined in problem statements 8 through 15.

2A7. Maximize natural and artificial production effectiveness in the subbasin—Continue existing and/or implement innovative production strategies in appropriate areas to support fisheries, natural production augmentation rebuilding and recovery, reintroduction, and research.

2A8. Monitor and evaluate effectiveness of implementation of artificial and natural production strategies including environmental strategies outlined in problem statements 8 through 15. Develop hatchery fish stocking and marking guidelines for all life stages to optimize the use of hatchery fish.

[1] SARs are presented because very little or no data are available regarding the current or potential numerical status of anadromous species within the Snake Hells Canyon subbasin. That information which is currently available or estimable is presented in Appendix A.

2A9. Monitor both the effects of limiting factors on populations and effects of restoration and management efforts aimed at minimizing impacts of limiting factors.

2A10. Evaluate progress in achieving the objective at least every 2 generations. Modify strategy 2A6 as necessary based on new information.

Discussion: Numerous out-of-subbasin impacts (e.g., passage to and from the subbasin, mainstem Snake/Columbia River conditions, estuarine and ocean conditions) combine to limit recruitment and/or success of anadromous species (see assessment section 4.1.1). Local participation in province- and basinwide planning and management will ensure coordination. Participation of subbasin managers in these broader-scale efforts will also enhance the understanding of, and ability to discern, management versus basinwide effects to fish populations within the subbasin.

Smolt-to-adult return rates (SAR) are indicative of the impacts of out-of-subbasin impacts to anadromous stocks, and it has been estimated that an average SAR from 2 to 6% is required for recovery of anadromous stocks in the Snake River basin. Recent efforts (Ecovista 2003) suggest that necessary SARs differ by species and should approximate 4 to 6% for spring chinook, 3% for fall chinook, and 4% for steelhead as measured at Lower Granite Dam.

A continued mixture of natural production and hatchery production strategies will be valuable to achieving subbasin goals, provided that hatchery effectiveness can be maximized and interactions of hatchery and wild fish can be further understood and reduced or prevented as necessary. Coordination of artificial propagation measures will occur with the appropriate planning processes currently underway (e.g., Artificial Production Review and Evaluation [APRE], HGMPs, and *U.S. v. Oregon*) to help ensure effectiveness of those efforts. Effectiveness of the implemented artificial propagation measures will be assessed through monitoring and evaluation to provide information relative to numerical goals and objectives and will guide adaptive management of the program. Continued research and monitoring of interactions between wild and hatchery components of populations will be necessary to ensure compatibility of the two approaches; additional information pertaining to this need is discussed in section 6.3 of this document.

Problem 3: Migratory and resident fish production is limited by habitat quantity, quality, and connectivity in portions of the subbasin.

Objective 3A: Increase migratory fish productivity and production, as well as life stage-specific survival, through in-subbasin habitat improvement.

Strategies:

3A1. Conduct research within the context of identifying and prioritizing management versus basinwide environmental effects.

3A2. Evaluate and quantify the loss of prey for white sturgeon within the subbasin. Determine the effect of loss of prey on white sturgeon.

3A3. Identify and prioritize primary limiting factors by migratory species life stage. Identify areas for protection as well as restoration using the information in assessment sections 4.1.2 - 4.1.4 as a starting point.

3A4. Prioritize limiting factors and actions to address limiting factors using information presented in section 8.1. Integrate priorities and actions with those outlined in problem statements 8 through 15.

3A5. Identify or develop indices to evaluate biological response(s) to habitat improvement projects, using appropriate fish production models or empirical data to link the developed index to fish production potential.

3A6. Implement projects following prioritization. Coordinate with implementation of strategies and actions delineated under problem statement 8 in section 5.2.2 below that address aquatic habitat directly.

3A7. Monitor and evaluate effectiveness of habitat improvement projects. Use indices developed in strategy 3A5 to monitor the effectiveness of habitat improvement efforts to provide biological benefits. Integrate results and other new information into the process by adapting management to reflect new information.

Discussion: This problem statement/objective/strategy set is aimed at addressing aquatic biological concerns through in-subbasin measures specifically. Although upstream (problem statement 1) and downstream (problem statement 2) out-of-subbasin factors substantially limit aquatic populations within the subbasin, addressing in-subbasin concerns will also be necessary to achieve biological goals established for the Snake Hells Canyon subbasin as part of this plan.

To limit redundancy noted during independent development of objectives and strategies for individual species, white sturgeon and anadromous species are considered collectively as "migratory species" under this objective. Although white sturgeon are currently limited only to local migrations by mainstem dams, their life history previously included long-distance migrations. Currently, the white sturgeon population in the subbasin is considered viable but appears to be declining, in part due to the fragmentation of habitat through hydropower development. Subbasin-specific information regarding the current life history, productivity, and habitat use by white sturgeon is more limited than that regarding anadromous species.

Naturally occurring spring and fall chinook, Pacific lamprey, steelhead, and white sturgeon (local migration only) are migratory species that exhibit reduced or declining populations and productivity in the Snake Hells Canyon subbasin. A combination of out-of-subbasin and in-subbasin strategies is required to achieve stabilization and/or recovery of these populations. The interconnectedness

between the productivity of migratory species and the condition of local habitats is implicit: the condition of one reflects the condition of the other. It is based on this premise that consideration of habitat improvement is included under biological objectives in this plan. Specific habitat problem and strategy statements are, however, detailed below in the section entitled "Environmental Components" (see problem statement 8 and associated objectives in section 5.2.2).

Based on a thorough review of existing data, it is not currently possible to quantitatively establish, with any degree of accuracy, life stage-specific determinations of survival, productivity, and production for migratory species in the Snake Hells Canyon subbasin. It is reasonable to assume, however, that migratory species production/productivity would improve given an improvement in the condition of the habitat within the subbasin and that these improvements can only occur with a reduction in impacts of defined limiting factors defined in section 4.1 of the subbasin assessment.

Objective 3B: Evaluate needs and opportunities to increase native resident populations (redband and bull trout) throughout the subbasin. Implement appropriate actions to address defined needs and opportunities.

Strategies:

3B1. Evaluate needs and opportunities to increase native resident fish populations by 2010.

3B2. Coordinate efforts to implement the existing bull trout recovery plan (USFWS 2002) to address needs of bull trout and other resident species.

3B3. Investigate possibilities for, and positive and negative biological and economic impacts of, enhancing fish passage.

3B4. Obtain and document information on ways to minimize the impacts of barriers and the biological benefits of enhancing passage.

3B5. Recommend actions that will address the needs determined above. Prioritize and implement projects using the prioritization method described in section 8.1. Coordinate projects with habitat restoration and protection projects under problem statement 8 in section 5.2.2 below and with terrestrial and aquatic habitat improvement projects.

3B6. Identify additional research needs to address limiting factors as implementation continues and conditions change.

Discussion: Little is known about the abundance, productivity, or carrying capacity related to redband and bull trout populations in the Snake Hells Canyon subbasin (see assessment sections 3.4.7 and 3.4.6, respectively). Limiting factors of resident fishes are, however, thought to be similar to those identified for some anadromous

species (see assessment sections 4.1.2–4.1.4) where the distributions/habitat uses overlap. The Qualitative Habitat Assessment (QHA) completed for steelhead largely addresses both bull trout and redband trout habitat areas by having considered the habitat condition of the entire length of each stream evaluated (see assessment section 4.1.4). However, given the lack of information specific to resident salmonids within the Snake Hells Canyon subbasin, further evaluation of the needs and opportunities required for their restoration will be required; in the interim, restoration and protection efforts and priorities derived from the completed QHA are expected to benefit resident species and should be utilized to do so. Currently identified opportunities to address habitat deficiencies are presented and discussed below under the "Environmental Components" section of this plan (section 5.2.2).

Reductions in numbers of smolts/parr, important prey for bull trout in this subbasin, are thought to be a limiting factor, although the impact has not been quantified. Adult and subadult bull trout are particularly reliant on anadromous species parr and smolts for the prey base (see assessment section 4.1.2). Evaluation and quantification of the loss of prey for bull trout within the subbasin are necessary.

Lack of fish passage at Hells Canyon Dam and inhibited fish passage at downstream dams negatively influence the viability of resident (as well as migratory) fish populations within the Snake Hells Canyon subbasin. More information is needed on ways to minimize the impacts of these barriers, the biological benefits of enhancing passage, and the economic impacts that would be associated with these measures.

5.2.1.2 Terrestrial Ecosystem

Problem 4: Limited information on the composition, population trends, interspecies interactions, habitat requirements, and ecosystem processes of many of the wildlife and plant (terrestrial) communities of the Snake Hells Canyon subbasin limits the ability to effectively manage or conserve these species (see assessment section 3.5).

Objective 4A: Increase understanding of the composition, population trends, interspecies interactions habitat requirements, ecosystem processes, and impacts of management activities on terrestrial communities of the Snake Hells Canyon subbasin.

Strategies:

4A1. Collect data—Develop a subbasinwide survey program and database for terrestrial focal species, ESA-listed species, sensitive species, Neotropical migrant species, culturally important species, amphibians, bats, and rare plant species.

4A2. Improve the documentation and data-sharing efforts of the Idaho Conservation Data Center, Oregon Natural Heritage Program, and Washington Natural Heritage Program within the subbasin.

4A3. Continue existing and expand research on the population dynamics habitat requirements and key environmental correlates (KECs) of the terrestrial species of the Snake Hells Canyon subbasin. Focus research on focal, ESA-listed, and culturally important species and their interrelationships.

4A4. Continue existing and expand research on processes such as fire regimes, hydrology, plant community dynamics, etc., that influence the terrestrial communities of the subbasin.

4A5. Continue existing and expand research on the biotic interactions and key ecological functions (KEFs) of the terrestrial communities of the subbasin (e.g., big game–livestock interactions).

4A6. Monitor and evaluate research needs in relation to limiting factors as implementation of habitat projects continues. Apply research and growing information base to management.

Discussion: Increasing the amount of data collection focused on terrestrial species will improve our understanding of and ability to manage these species. Establishing a baseline understanding of current habitat conditions, ecosystem functions and population numbers will allow managers to evaluate the effects of future management activities and swiftly adapt them if necessary. Species identified as particularly in need of further survey during the assessment process include Spalding's silene (also known as Spalding's catchfly), especially in the Oregon portions of the subbasin containing suitable habitat, and mountain quail.

Problem 5: Changes in the presence or abundance of particular key environmental correlates (KECs) or other habitat elements have decreased the subbasin's ability to support certain wildlife species.

Objective 5A: Maintain and enhance populations of focal, sensitive, and threatened and endangered species in the subbasin

Strategies:

5A1. Implement the habitat improvement strategies outlined in problem statements 8 through 15.

5A2. Continue to gather information on the terrestrial species and ecosystems as described in problem statement 4.

5A3. Prevent vandalism of bat hibernacula. Monitor and maintain the condition of existing gates and continue to add gates to protect important bat roosting and breeding areas (see assessment sections 3.5.9 and 4.2.2).

5A4. Prevent the establishment of or reduce the potential impacts of introduced wildlife species (bull frog, starling) and domestic predators (cats, dogs) (see assessment section 3.2.2).

5A5. Maintain the quality of the travel corridor connecting forest habitats in the Rocky Mountains with habitats in the Blue Mountains that occur in the upper subbasin (see assessment section 3.1.2 and 4.2.2).

5A6. When implementing the habitat strategies, incorporate the population dynamics and genetic flow issues of wildlife species in the subbasin. Prioritize actions in areas that will improve population connectivity and expand existing ranges.

5A7. Fund the reintroduction of appropriate native focal, sensitive, or threatened and endangered species into the subbasin where appropriate high-quality habitat is available.

Discussion: The above strategies address important threats and limiting factors to the wildlife species of the subbasin that will not be corrected by addressing habitat-level limiting factors discussed in problem statements 8 through 15. The narrow canyon and forested habitats of the Seven Devils area may provide the only suitable travel corridor linking subpopulations in the two states.

Problem 6: Hells Canyon Dam negatively impacts terrestrial species and habitats within the subbasin.

Objective 6A: Mitigate the negative impacts of Hells Canyon Dam on terrestrial species and habitats.

Strategies:

6A1. Integrate mitigation developed for resource impacts from Hells Canyon Dam in the Hells Canyon FERC relicensing process with the BPA/NPCC process. Protect wildlife populations and habitat through conservation easements, land acquisition, and other appropriate strategies.

6A2. Implement the strategies under problem statement 11 about addressing the loss and degradation of riparian and wetland habitats and under problem statement 15 about the need to restore nutrients, reduce impacts of reductions in salmon populations to the wildlife of the subbasin, and mitigate for impacts of the hydropower system to riparian and wetland habitats.

6A3. Recommend FERC license conditions or modifications that will reduce the impacts of the hydropower system on the wildlife populations of the subbasin.

6A4. Monitor and evaluate effectiveness of measures in mitigating negative impacts of Hells Canyon Dam and Complex on terrestrial species.

Discussion: Idaho Power Company (IPC) is currently in the process of relicensing the Hells Canyon Complex through FERC. The relicensing process requires IPC to

conduct a thorough assessment of impacts of their dams' operations on natural resources and to mitigate for those impacts. The goals of the FERC relicensing process are very similar to the goals of NPCC subbasin planning. The two processes should be integrated to achieve mitigation for the impacts of the hydropower system on fish and wildlife populations in the subbasin. Much of the information gathered by IPC during the preparation of its license application to FERC was used in the *Snake Hells Canyon Subbasin Assessment*. The Technical and Planning Teams for the Snake Hells Canyon subbasin expect that IPC will be a valuable partner in implementing the recommendations of this management plan.

Problem 7: The grazing of livestock in the subbasin has negatively impacted populations of native wildlife and plants.

Objective 7A: Reduce conflicts between livestock and native wildlife and plant populations through the development of a comprehensive basinwide and site-specific grazing management plan for the subbasin.

Strategies:

7A1. Protect important plant populations—Develop grazing management plans to limit adverse impacts to rare or culturally important, ESA-listed, etc., plant populations and habitat.

7A2. Prevent seed dispersal—Minimize the potential for livestock to facilitate the spread of noxious weeds through weed-free hay programs, quarantine requirements, avoidance of grazing during periods of seed dispersal, and other actions.

7A3. Modify grazing timing and intensity to reduce the risk of erosion, soil compaction, alteration of vegetative communities, and damage to microbiotic crust.

7A4. Reduce cattle/elk conflicts—Develop a grazing management plan to minimize cattle/elk conflicts, especially on elk winter range areas. Include the installation of off-site watering facilities where appropriate and establishment of maximum forage utilization standards for livestock on big game winter range.

7A5. Monitor and evaluate efforts to reduce impacts of cattle on plant and wildlife species. Modify implementation strategies as necessary.

Discussion: Livestock grazing is an important economic activity in the subbasin and most of the subbasin has been grazed. Historic overgrazing has damaged grassland and riparian communities in some areas and facilitated the invasion and spread of noxious weeds and other invasive plants. Recent changes in grazing practices and

reduced grazing levels in much of subbasin have resulted in improved habitat quality. Continuing to implement and develop best grazing practices will protect areas of high-quality habitat in the subbasin and allow areas that have been damaged by grazing to recover. Working to minimize grazing impacts in areas that support rare plant populations or provide important elk winter ranges will preserve these important habitats and the species that depend on them (see assessment sections 3.5 and 4.2 for more details).

Objective 7B: Eliminate domestic sheep and goat grazing within bighorn sheep habitat.

Strategies:

7B1. Increase public and landowner education programs to improve the understanding of the threat of passing *Pasteurella* from domestic sheep to bighorn sheep.

7B2. Eliminate area where interaction between bighorn sheep and domestic sheep is likely through grazing restrictions, land acquisition, fee title acquisitions, conservation easements, or land exchanges.

7B3. Work with the U.S. Forest Service (USFS) to retire last remaining sheep allotment on public land in the subbasin, located on the Payette National Forest.

7B4. Monitor and evaluate the effectiveness of eliminating domestic sheep and goats from bighorn sheep habitat in protecting bighorns from *Pasteurella*.

Discussion: Disease is the primary limiting factor to bighorn sheep in the subbasin (Cassirer IDFG, personal communication, 2004). When bighorn sheep come in contact with domestic sheep infected with *Pasteurella,* bighorns usually die of pneumonia within 3 to 7 days of contact (Martin et al. 1996, Schommer and Woolever 2001). A recent outbreak of from *Pasteurella* was documented within the Big Canyon herd on April 8, 2004 (Barker 2004). Field treatment of *Pasteurella* with antibiotics has had some success, but prevention of infection is the goal of the wildlife management agencies in the subbasin.

The most effective prevention is separation between bighorns and domestic sheep or goats. The presence of domestic sheep and goats in the subbasin has been dramatically reduced in recent years. All sheep allotments on the Wallowa-Whitman National Forest have been discontinued (USFS 2003). Only a few areas of domestic sheep use remain: a single public land grazing allotment on the Payette National Forest allows domestic sheep grazing. There are a few commercial sheep- and goat-grazing operations within or adjacent to the Snake Hells Canyon subbasin that continue to provide disease transmission opportunities to wild bighorns. Most notably are a sheep herd in lower Joseph Creek and a herd of goats based in the White Bird, Idaho, area that are used in weed control efforts. Domestic sheep and goats are also kept sporadically in small quantities as hobby animals in the river bottoms of the Snake River system and adjacent

subwatersheds. Working with public and private land managers to remove domestic sheep from the subbasin will increase the suitability of the subbasin for supporting bighorn sheep (see assessment sections 3.5.2 and 4.2.2).

5.2.2 Environmental Components

Problem 8: Water quantity and quality are key environmental factors that limit the production of native fish species and aquatic wildlife.

Objective 8A: Restore natural flow regime that supports and meets the life history needs of aquatic species in the subbasin.

Strategies:

8A1. Determine adequate flows and habitat suitability indices for specific life history stages of all focal fish species.

8A2. Identify flow-related limiting factors for fish, wildlife, and riparian habitat and identify actions to address limiting conditions at finer scales than presented in the assessment.

8A3. Establish, via the FERC relicensing process for Hells Canyon Dam or license amendments, requirements to modify operations to provide suitable flows sufficient to support all life stages of anadromous fish at maximum achievable numbers, support wildlife, and support riparian function.

8A4. Determine effects of Lewiston Orchards Irrigation District diversion on flow in Captain John Creek and protect fish from any negative impacts.

8A5. Implement activities to protect and improve flow in mainstem and tributaries.

a. Develop estimates of minimum flows needed to support fish, hydrologic function, and riparian function in tributaries.

b. Acquire water rights for minimum instream flows in tributaries.

c. Identify and implement water conservation measures to increase flows. Restore natural hydrograph in tributaries.

d. Coordinate with Idaho Power Company (IPC) via FERC relicensing and other avenues to restore flow and related (e.g., temperature) regimes in the mainstem.

e. Monitor and evaluate the effectiveness of measures to restore flow and flow regimes to meet specified physical and biological objectives. Revise management strategies as needed.

Discussion: Mainstem base flows and flow variation, in part, limit fall chinook and white sturgeon populations in the subbasin (see assessment section 4.1.3). IPC currently implements protective flows for fall chinook spawning (10,000 cubic feet per second [cfs] during spawning and incubation). Although beneficial, it is not clear that these flows are optimal for fall chinook or other species utilizing mainstem habitats. Additional work is necessary to define optimal mainstem flows for all species and should consider and build from the recent work done by IPC relating flows to mainstem habitat conditions. Based on the outcomes of such investigations, consultation with IPC should occur to negotiate modifications to operations to benefit fish and wildlife.

Restoration of more natural flow conditions is necessary and has been prioritized in numerous tributaries to enhance habitat conditions for steelhead and other tributary spawners (see assessment section 4.1.4). Tributaries limited by both high and low flows include Dry, Divide, Getta, and Captain John creeks. Cave Gulch and Redbird and Cottonwood creeks have prioritized needs for restoration of high flows; Corral Creek (South) has a prioritized need for restoration of low flows. Within the Snake Hells Canyon subbasin, Captain John Creek is uniquely impacted by headwater withdrawal by Lewiston Orchards Irrigation District; the direct impacts of this withdrawal are unknown and need to be evaluated and quantified to determine whether additional mitigative or protective actions may be necessary.

Objective 8B: Provide temperature regimes that meet the life stage-specific needs of aquatic focal species.

Strategies:

8B1. For the tributaries—Inventory and prioritize areas where temperature is most limiting to target species. Conduct habitat inventories in priority areas of the subbasin, placing emphasis on canopy closure/stream shading data collection. Develop a water temperature database for the subbasin. Prioritize causes for temperature exceedances, actions to address temperature problems, and project areas. Prioritization needs to consider cost effectiveness and potential biological responses. This prioritization will determine sequencing of activities in strategies 8B2 and 8B3.

8B2. For the tributaries—Identify riparian, wetland, and floodplain areas where degraded conditions contribute to high summer temperatures.

8B3. For the tributaries—Restore riparian functions, including wetland and floodplain areas. Continue efforts aimed at increasing streamside shading where streamside shading has been reduced by anthropogenic activities. This includes implementing forest and agricultural best management practices (BMPs).

8B4. For the tributaries—Restore upland watershed conditions (e.g., riparian areas) and functions (e.g., storage/recharge, flows) impacting water temperatures.

8B5. For the tributaries—Identify additional sources of temperature exceedances. Implement existing and develop new TMDLs, EAWSs, and other watershed-scale assessments to define localized factors negatively influencing temperature regimes. Differentiate between natural and anthropogenic influences. Add existing information to database.

8B6. For the tributaries—Monitor and evaluate the results of all implementation strategies. Integrate data with other new information and revise assessment and priority strategies. Repeat implementation and monitoring and evaluation strategies until water temperature is no longer a problem in the subbasin.

8B7. For the mainstem—Investigate creative measures to allow future modifications to Hells Canyon Dam operations. Identify and prioritize most effective measures.

8B8. For the mainstem—Work within existing or create new regional forums to identify and implement projects to restore temperature conditions to meet the life history needs of the focal species.

8B9. For the mainstem—Implement measures identified in the existing mainstem TMDL to improve mainstem temperatures.

8B10 Monitor and evaluate the effectiveness of projects to restore temperatures o meet requirements state water quality standards and support of focal species. Revise management strategy as needed.

Discussion: Using QHA, temperature conditions are prioritized for restoration in Getta Creek and Cave Gulch. Riparian condition, which directly influences temperature conditions, has been prioritized (using QHA) for restoration in 19 of 21 tributaries prioritized for restoration activities in the subbasin (see assessment sections 4.1.4). Project planning and implementation undertaken to address these issues should evaluate the potential cost effectiveness and biological response of proposed efforts and modify priorities identified in the subbasin assessment as necessary to account for that information. Methods used (QHA) in the subbasin assessment to identify restoration needs and priorities in tributary habitats are not designed to account for all potential impacts to habitat conditions nor cumulative effects of issues identified. Existing forums designed to more stringently evaluate impacts to local fish and wildlife populations and finer scales (e.g., TMDLs, EAWSs, and other watershed-scale assessments) should be maintained to further define and prioritize factors influencing temperature regimes. Riparian restoration strategies under objective 11A should also help address temperature problems.

Mainstem temperature standards related to use by coldwater biota are routinely not met within the Snake Hells Canyon subbasin. (Each state/management agency is required to meets its own standards to comply with state and federal laws. In some cases, optimal temperature regimes for fish and wildlife may be different than those required to meet legal requirements associated with those standards.) Fall chinook are limited, in part, by seasonally shifted thermal regimes due to operations of upstream hydropower dams (see assessment sections 4.1.2 and 4.1.3). Impacts include delays in both spring warming and fall cooling, which negatively impact incubation, growth, and migration timing. A TMDL is currently in development for the mainstem Snake River and will serve as one tool for definition of actions that can be taken to ameliorate negative impacts of current thermal regimes, but it is likely to address only issues with high summer and fall temperatures (increased warming and delayed cooling). Additional efforts will almost certainly be necessary to address low spring temperatures (delayed warming) in the mainstem Snake River below Hells Canyon Dam as a result of dam operations and other factors.

Objective 8C: Reduce sediment and sedimentation in tributaries to levels that can support life history requirements of focal species.

Strategies:

8C1. Identify problems and actions to address sediment problems. Implement existing and continue to develop TMDLs, EAWSs, and other watershed-scale assessments designed to define sediment sources and actions aimed at reducing or eliminating sediment impacts (see inventory section 4.2).

8C2. Develop a coordinated sediment production, transport, and fate monitoring program through existing monitoring entities where possible.

8C3. Utilize and refine QHA data to inventory and prioritize areas where sediment reductions would be most beneficial to various target species (see assessment section 4.1.2).

8C4. Reduce sediment inputs by cooperatively implementing and enforcing practices that address sediment sources from logging, mining, agriculture, and other historic and current sediment-producing activities.

8C5. Monitor and evaluate results of all implementation activities. Integrate new data and information into strategies 8C1 to 8C3. Revise and repeat implementation strategies until problem is adequately addressed.

Discussion: Excess fine sediment in tributary systems will negatively impact all salmonid species in those habitats; in the Snake Hells Canyon subbasin, these species include spring chinook, steelhead, redband and bull trout, and possibly Pacific lamprey. Based on QHA results, fine sediment is a priority issue for restoration in 17 of 21 tributaries prioritized for restoration activities in the subbasin (see assessment section 4.1.4). Project planning and implementation undertaken to

address sedimentation should evaluate the potential cost effectiveness and biological response of proposed efforts and modify priorities identified in the subbasin assessment as necessary to account for that information. Methods used (QHA) in the subbasin assessment to identify restoration needs and priorities in tributary habitats are not designed to account for all potential impacts to habitat conditions nor cumulative effects of issues identified. Existing forums designed to more stringently evaluate impacts to local fish and wildlife populations and finer scales (e.g., TMDLs, EAWSs, and other watershed-scale assessments) should be maintained in order to further define and prioritize factors negatively influencing sediment regimes.

Existing sediment standards used in TMDL development are typically narrative and not numeric, making them difficult to implement and enforce. Standards applied in TMDL development (e.g., total suspended solids) are a way to measure sediments entrained in the system, but they rarely inhibit fish production directly. Riparian restoration measures aimed at providing terrestrial benefits and mitigating water temperatures will address sediments. Additional reductions in sediment can be expected via TMDL sediment control activities. The effectiveness of sediment reduction/control and other water quality projects should be measured by comparing changes in sediments/turbidity/total suspended solids with trends in fish populations. In addition, success of sediment control projects should be measured by monitoring sediment and sediment-related conditions that directly affect fish survival and production (e.g., percent fines in spawning gravels, embeddedness, habitat alterations, etc.). Restoration efforts aimed at sediment reductions should coordinate with and continue implementation of activities defined in existing or future TMDLs (related to Corral, Divide, Getta, Wolf, and Deep creeks), although project monitoring and evaluation of success should be tied more closely to conditions directly related to aquatic species production.

Problem 9: The introductions of noxious weeds and nonnative plant species into the Snake Hells Canyon subbasin have negatively impacted native terrestrial focal habitats and species.

Objective 9A: Protect the existing quality, quantity, and diversity of native plant communities providing habitat to native wildlife species by preventing the introduction of noxious weeds and invasive exotic plants into native habitats.

Strategies:

9A1. Identify and prioritize native plant communities and rare plant populations for protection from exotic weeds using this and other plans, county weed boards, or other sources that provide weed information. Prioritize by expected biological response, community rarity, and uniqueness.

9A2. Prevent new infestations—Minimize ground-disturbing activities in habitats highly susceptible to weed invasion. Following disturbance, revegetate using certified weed-free seed.

9A3. Prevent seed dispersal—Provide technical assistance and develop and distribute BMPs to the appropriate entities to reduce the incidence of noxious weeds and nonnative plants within the subbasin. Emphasize the use of an integrated pest management strategy and implement programs and policies designed to limit the transportation of weed seeds from vehicles and livestock.

9A4. Seek funding for and provide technical assistance to existing weed management programs (see Subbasin Inventory), including the Idaho Weed Management Strategy and weed programs of the Bureau of Land Management (BLM), USFS, Nez Perce Tribe, IDFG, and other appropriate agencies.

9A5. Develop education and awareness programs in noxious weed identification, spread, prevention, and treatment.

9A6. Minimize establishment of new invasive plants by developing and implementing early detection and eradication programs.

9A7. Monitor and evaluate the effort to protect native plant communities from exotic plants. Integrate new information into strategy 9A1 and modify implementation strategies as necessary.

Discussion: Noxious weeds and other invasive plant species pose one of the greatest threats to the wildlife habitats of the subbasin. They often outcompete native plant species and alter ecological processes, reducing habitat suitability (Quigley and Arbelbide 1997). Many invasive species are not palatable to either livestock or wildlife, nor do they provide suitable habitat for wildlife species.

Weed problems in the subbasin are most severe in the grassland habitats. The naturally open structure of the subbasin's grassland vegetation, its soils and climate, and the transport provided by the Snake River have predisposed the subbasin to invasion by weeds, especially by species of Mediterranean origin. Invasive plant species are more established in the lower areas of the subbasin where disturbance has been the most intense, but invasive species in the subbasin are spreading and are becoming increasingly prevalent in the HCNRA and wilderness areas of the upper subbasin (USFS 2003). Preventing the spread of noxious weeds and other invasive plants into areas of relatively pristine habitat is one of the highest priorities for wildlife management in the subbasin (see section 8.2). Effective education programs that help residents and visitors to the subbasin identify noxious weeds and learn how to reduce or prevent their spread will be critical to this effort. The introduction and spread of invasive species is tied to other activities in the subbasin including road construction and use, livestock

grazing, fire, timber harvest, and other soil-disturbing activities. Strategies developed by the Technical Team to address these issues were developed in objectives 7A, 7B, 13A, and 14A. Implementing these strategies will also help to reduce the impact of introduced plant species on the subbasin (see assessment section 4.2.2 for more details).

Objective 9B: Reduce the extent and density of established noxious weeds and invasive exotics.

Strategies:

9B1. Prioritize for treatment—Identify and prioritize noxious weed infestations for treatment in cooperation with existing efforts in the subbasin (see inventory section 2.1). Prioritize according to cost effectiveness, expected biological response, community rarity, and uniqueness. Integrate new information with existing inventories and management efforts.

9B2. Treat weed infestations—Use integrated pest management principles to implement the most economical and effective treatment methods for reducing weed densities or eliminating weed populations. Use the area- and species-specific Weed Management Objectives and Priorities developed and being developed by the Cooperative Weed Management Area Committees in the subbasin.

9B3. Develop new, effective BMPs and inform suitable audiences about their appropriate implementation. Prioritize efforts focused on developing cost-effective methods for reducing or eliminating cheatgrass.

9B4. Monitor and evaluate efforts to reduce weeds. Integrate new information into strategy 9B1 and modify implementation strategies as necessary.

Discussion: As discussed in the preceding objective, noxious weeds and invasive plants degrade habitat and reduce its suitability for native plants and animals. These invaders are also economically expensive in terms of control measures and reductions in yield for agriculture and ranching. The battle against noxious weeds is often discouraging. Limited funding, difficulty in coordinating efforts, and the need for greater public education into the problem and strategies for noxious weed control all add to the difficulty. Coordination of noxious weed control activities in the Snake Hells Canyon subbasin is particularly challenging due to the subbasin's tri-state nature and the many groups working on noxious weed control within its boundaries (see inventory section 2.1). Although the effort is still young, the release of biocontrol agents to attack yellow starthistle in the lower subbasin appears to be achieving positive results (L. Daly, BLM, personal communication, 2003). Such results provide hope; stopping the spread and reducing densities of this particularly heinous invader will provide benefits to numerous grassland-dependent wildlife species and increase forage quality for livestock. Continuing efforts to develop effective controls and practices for

reducing the prevalence of other invasive species in the subbasin could provide similar far-reaching benefits (see assessment section 4.2.2 for more details).

Problem 10: The loss and degradation of the grassland habitats of the subbasin have negatively impacted numerous native plant and animal species dependent on these habitats.

Objective 10A: Protect existing good condition grasslands. (See discussion section below for description of how the management agencies of the subbasin define this.)

Strategies:

10A1. Continue to inventory, map, and establish the condition of grassland habitats within the subbasin.

10A2. Identify priority grassland areas for protection and restoration—Give priority to larger intact remnants and those that contain rare species.

10A3. Protect remaining high-quality grassland habitats through land acquisition, fee title acquisitions, conservation easements, or land exchanges.

10A4. Implement the noxious weed prevention and reduction strategies outlined in objectives 9A and 9B and the strategies to limit the impacts of grazing on the ecosystem outlined in objective 7A.

10A5. Monitor and evaluate the effectiveness of grassland protection strategies and the response of wildlife and fish focal, threatened and endangered, and sensitive species. Modify strategies as necessary based on new information.

Discussion: The Snake Hells Canyon subbasin contains some of the healthiest grassland communities remaining in the Columbia Basin. Ten concern or focal wildlife species in the subbasin have been identified as being closely associated with grassland habitats (see assessment section 3.5.2 for more details). Grassland habitats are inhabited by numerous rare plant species in the subbasin including two species listed as threatened under the Endangered Species Act, MacFarlane's four o'clock and Spalding's silene.

The subbasin's high-quality grasslands may be providing critical refuges for grassland-dependent wildlife species that have lost habitat over much of their range. The relatively natural species composition and structural condition of sites in the subbasin may provide important reference information that will help guide future restoration efforts in grassland communities in other parts of the Columbia Basin.

Identifying and protecting high-quality grassland areas in the subbasin should be a priority (see section 8.2). The BLM and USFS have begun efforts to identify high-quality grassland habitats in the subbasin, and these efforts need to be expanded and continued. Once the highest quality areas in the subbasin are

identified, the need for protection should be assessed. Large intact areas that may be capable of supporting area-dependent grassland species such as the grasshopper sparrow or areas with rare or endangered elements should be given priority (see assessment section 4.2.2 for more details).

Objective 10B: Restore degraded grasslands to good condition. Increase the coverage of native perennials, including bluebunch wheatgrass and/or Idaho fescue.

Strategies:

10B1. Continue to research techniques for effectively restoring grassland habitats and reducing or eliminating noxious weeds and cheatgrass.

10B2. Establish the role of fire in maintaining natural grassland systems. Research its potential as a restoration tool.

10B3. On abandoned agricultural areas, plant native grasses, forbs, and shrubs that will provide food and cover for wildlife.

10B4. Implement grazing strategies that reduce the impact of livestock on native grassland and microbiotic crust communities (see objective 7A).

10B5. Restore grassland habitats—Actively improve or create native grassland habitats through noxious weed control, management practices, and seeding with native species.

10B6. Continue existing programs that work to acquire and restore grassland habitats. Develop new programs to acquire and restore grassland habitats.

10B7. Monitor and evaluate the effectiveness of grassland restoration in the subbasin and the response of wildlife and fish focal, threatened and endangered, and sensitive species to changes in condition and area of grassland. Modify strategies as necessary based on new information.

Discussion: Although the grassland habitats of the Snake Hells Canyon subbasin are some of the healthiest remaining in the Columbia Basin, they have still been affected by the disturbances that have eliminated most of these communities in the region (USFS 1999). Approximately 41,639 acres of the subbasin that once contained native grasslands have been converted to agriculture, pasture, or urban environments. Most of this conversion has occurred in the northern/downstream portion of the subbasin. Some areas of historical farming in the subbasin are no longer being cultivated; restoring these areas to native grasslands will increase the availability of grassland habitats in the subbasin.

The primary causes of grassland degradation in the subbasin have been livestock grazing and introduction of noxious weeds and cheatgrass. Strategies for reducing the impacts of these factors are described in objectives 7A, 9A, and 9B.

Once established, cheatgrass outcompetes native bunchgrasses and is very difficult to remove. In the past, efforts at restoring areas dominated by cheatgrass have been marginally successful at best. The development of more successful and cost-effective techniques for reducing and eliminating cheatgrass and restoring native bunchgrass communities will have immeasurable benefits to grassland restoration efforts and grassland-dependent wildlife species. The development of more cost-effective methods for reducing the prevalence of noxious weeds in the subbasin will have similar benefits.

Fire frequencies in grassland habitats of the subbasin are thought to have been more common historically. Fire frequency in grassland habitats of the area have been reduced as a result of fire suppression and fuel reduction due to livestock grazing (BLM 2002). But conditions in the subbasin are changing: shrubs have become more decadent, and the litter that has accumulated beneath vegetation creates the potential for fires that are more severe and spread more rapidly. Cheatgrass dries early in the season, and its invasion has caused an earlier fire season and the possibility of increased fire frequency. Recent reductions in livestock grazing in some areas of the subbasin have increased fine fuel accumulation and may eventually increase fire frequencies. Severe fire has the potential to damage bunchgrass communities. Light and moderate burns enhance bluebunch wheatgrass, but severe burns have the potential to negatively affect the species (Johnson 1998). Idaho fescue is more susceptible to fire, especially during late summer, and may require several years for recovery, but is unlikely to be eliminated by fire (Wright et al. 1979).

More research is needed into the role of fire in grassland ecosystems and its potential as a restoration tool. Early spring burning has been proposed as a management tool for reducing fuel loads and the risk of intense fire, but it can increase invasion by noxious weeds and invasive species. Early spring burning should be employed only in areas of high-quality grasslands, and then the results should be carefully monitored. See assessment sections 4.2.2 for more details about grassland habitats.

Problem 11: The loss or degradation of wetland and riparian habitats in the subbasin has negatively impacted the numerous wildlife species that utilize these habitats.

Objective 11A: Protect and restore riparian habitats.

Strategies:

11A1. Identify and prioritize riparian habitats for protection and restoration. Give highest priority to riparian habitats supporting spawning and rearing for anadromous and native resident salmonids or providing current or potential habitat for mountain quail (see assessment sections 3.4 and 3.5.6).

11A2. Protect riparian communities through land purchase, fee title acquisitions, conservation easements (including CRP, CREP, WHIP, and similar habitat protection and improvement programs), land exchanges, implementation of BMPs, land stewardship, implementation of alternative grazing strategies, and installation of alternative livestock watering systems.

11A3. Establish riparian pasture systems, exclusion fences, off-site watering areas, or riparian conservation easements. Adjust seasonal timing of livestock grazing to minimize soil compaction, damage to vegetative communities, erosion, and noxious weed propagation.

11A4. Restore continuous brushy riparian corridors from the mouth of tributary streams to forested habitats. Prioritize areas of current or historic mountain quail use or suitable habitat for mountain quail.

11A5. Identify and prioritize tributary riparian habitat areas for improvement as mitigation for impacts of hydropower system-induced water fluctuations on mainstem riparian habitat.

11A6. Initiate protection and restoration projects to improve tributary riparian habitat to mitigate for the impacts of hydropower system-induced water fluctuations on mainstem riparian habitat.

11A7. Increase stewardship and public knowledge—Increase understanding of the importance of riparian habitat through education programs.

11A8. Monitor and evaluate efforts to protect and restore riparian habitats. Monitor wildlife and fish populations to measure responses to riparian habitat improvements. Integrate new information into strategy 11A1 and modify implementation strategies as necessary.

Discussion: Riparian habitats in the Snake Hells Canyon subbasin have been altered through various human activities, most notably upstream hydropower development and livestock grazing. Riparian habitats are very important to both terrestrial and aquatic communities in the subbasin, and these changes have the potential to impact numerous species. Twenty-eight concern or focal species have been identified as closely associated with the herbaceous wetland or interior riparian wetland WHTs (see assessment section 4.2; Johnson and O'Neil 2001)

The Hells Canyon Complex has altered flow and interrupted sediment processes within the mainstem Snake River. A comparison of sandbars before and after the installation of the Hells Canyon Dam found that the surface area and number of beaches had declined by 75%, resulting in fewer depositional sites where riparian communities can develop (USFS 1999). Sandbars and islands were always limited by the narrow, rocky canyon of the subbasin, but a comparison of photographs taken before the construction of Hells Canyon Dam (1950s) and current (1999) photographs indicates that fewer of these areas, especially smaller sites, may exist today than in the 1950s and that they may have changed in extent.

A reduction in the distribution of sandbar willow over this time period was also noted, while hackberry was found to be more abundant (Blair et al. 2001). The reduced abundance of sandbars and islands and the changes in the vegetative composition of riparian areas have implications for the numerous wildlife species that use these mainstem riparian habitats. Many of the impacts to mainstem riparian habitats caused by the altered flow and sediment processes associated with the Hells Canyon Complex may not be correctable while these dams continue to operate. Instead, efforts to improve the availability of high-quality habitat for riparian-dependent species in the subbasin may need to focus on improving riparian conditions along tributary habitats to mitigate for loss or degradation of riparian areas along the mainstem. Increasing connectivity in tributary riparian habitats should provide movement corridors and benefit mountain quail populations in the subbasin (see assessment section 3.5.6).

Heavy grazing has impacted the health of the riparian communities in the subbasin, but recent efforts to exclude cattle from riparian areas, use of BMPs, alternative grazing strategies, changes in grazing timing, and other factors have resulted in improvements in riparian condition across much of the subbasin (see assessment section 4.2.2). Continued and expanded implementation of these strategies (as described in problem 7A) should result in continued improvements in the riparian habitats of the subbasin and provide abundant, well-distributed, high-quality riparian habitat that will support the many wildlife and fish species that depend on these habitats.

Objective 11B: Protect all currently functioning wetland habitats (including seep, spring, and wet meadow and other wetland areas). Restore degraded wetland habitats that provide or have the potential to provide important fish and wildlife habitats.

Strategies:

11B1. Fund the efforts of the USFWS and collaborators to finalize and digitize National Wetlands Inventory maps across the subbasin.

11B2. Use the methodology developed by Jankowsky–Jones (1997; 2001) and being employed in many other areas of the state (or other appropriate methodology) to inventory, assess functionality, and prioritize for restoration or protection the wetland habitats of the subbasin. Use importance to wildlife (for example, hibernacula for amphibians) as a major criterion in the prioritization process.

11B3. Improve water quality of existing wetlands through restoration activities and landowner education. Prioritize efforts based on importance to focal, sensitive, and threatened and endangered fish, wildlife, and plant species.

11B4. Protect wetland habitats through land acquisition, fee title acquisitions, conservation easements, land exchanges, public education, promotion of BMPs, implementation of the travel plan developed in objective 14A,

promotion of alternative grazing strategies, and installation of alternative forms of water for livestock.

11B5. Monitor and evaluate effort to protect functioning and restore degraded wetlands. Monitor focal wildlife and fish populations to measure responses to wetland habitat improvements. Integrate information into strategy 11B1 and modifying activities under strategies 11B2 and 11B3 as necessary based on new information.

Discussion: Wetland habitats are relatively rare in the steep, arid Snake Hells Canyon subbasin, but partially due to their rarity, these areas provide very important habitat for wildlife species including the Columbia spotted frog and mountain quail focal species (see assessment section 3.5.6). The location, condition, and function of the wetland habitats of the subbasin are not well understood or documented. Completion of inventory efforts and the development of restoration and protection priorities will be an important first step to wetland preservation. Grazing and off-highway vehicle use represent substantial threats to wetland communities, and implementing the strategies in objectives 7A and 14A to minimize the impacts of these activities on the natural resources of the subbasin will also provide substantial benefits to wildlife. Because they tend to provide benefits to fish, wildlife, and water quality that are out of proportion with their relatively small size, functional wetland areas are good candidates for protection through land acquisition or conservation easements (see assessment section 4.2.2 for details).

Problem 12: Reductions in the extent of mature ponderosa pine habitats in the subbasin have negatively impacted the numerous wildlife species that utilize these habitats.

Objective 12A: Protect mature ponderosa pine habitats.

Strategies:

12A1. Continue efforts to inventory and map existing mature ponderosa pine habitats.

12A2. Identify mature ponderosa pine communities for protection—Prioritize larger remnants and those with highest potential to be lost or degraded.

12A3. Protect existing ponderosa pine communities—Protect existing mature ponderosa pine communities through land purchase, fee title acquisitions, conservation easements, land exchanges, or other strategies. Encourage the planting of ponderosa pine in existing state, federal, and tribal reforestation efforts where appropriate to habitat type.

12A4. Maintain ponderosa pine communities—Where appropriate to the habitat type, use understory removal and/or prescribed burning to protect mature stands from stand-replacing fire events.

12A5. Monitor and evaluate effectiveness of mature ponderosa pine protection activities to reduce negative impacts to wildlife species. Monitor focal wildlife and fish populations to measure responses to ponderosa pine habitat improvements. Integrate new information into strategies 12A1 and 12A2. Modify implementation strategies as necessary.

Discussion: Ponderosa pine forests have decreased across the Columbia Basin, with an even more significant decrease in mature ponderosa pine habitats (Quigley and Arbelbide 1997). Similar reductions have occurred in the Snake Hells Canyon subbasin. In the BLM EAWS study area, ponderosa pine habitats have experienced a significant decline due to timber harvest of mature ponderosa pine and fire suppression (BLM 2002). Reductions in this habitat type are thought to be less severe in the HCNRA than in other areas of the Columbia Basin and Snake Hells Canyon subbasin. This difference is primarily due to the large areas designated as wilderness where timber harvest is now precluded and the uneven-aged forest management practices adopted on the HCNRA in 1975; however, declines in the ponderosa pine habitat have occurred (USFS 1999).

Before the initiation of logging and fire suppression, ponderosa pine was maintained by regular underburning. Many areas of the subbasin covered by open ponderosa pine habitats are now dominated by denser stands of shade-tolerant tree species. These changes have likely impacted populations of ponderosa pine-dependent wildlife species in the subbasin. Ponderosa pine habitats are important to a variety of wildlife in a variety of ways. Nearly all bald eagles observed in the Craig Mountain area were perched in mature ponderosa pine trees along the Salmon and Snake rivers (Cassirer 1995). The focal species, the white-headed woodpecker, is completely dependent on the seeds of the ponderosa pine for winter feeding and shows a preference for these habitat types for nesting and foraging during other seasons of the year. Flammulated owl habitat includes open stands of fire-climax ponderosa pine or Douglas-fir forests (see assessment section 3.5.5 for details). Six focal or concern wildlife species in the subbasin are closely associated with ponderosa pine habitats, and many more use these habitats (see assessment section 4.2.2 for details).

Areas containing mature stands of ponderosa pine were identified in the Lower Snake River EAWS (BLM 2002). Mature stands of ponderosa pine were rare in all subwatersheds in the study but were most prevalent in the Captain John and Corral Creek subwatersheds. Protecting these identified areas of mature ponderosa pine and continuing inventory efforts to identify additional areas for protection should be a priority.

Objective 12B: Use management practices to develop or restore ponderosa pine communities in areas where this species was historically present.

Strategies:

12B1. On sites where ponderosa pine would have historically been dominant but are now absent or reduced, identify and prioritize areas to develop into ponderosa pine communities.

12B2. Use appropriate harvest or fire treatments to recover open and two-story stands dominated by medium and large ponderosa pine.

12B3. Evaluate artificial regeneration as a tool for establishing ponderosa pine stands on suitable sites where sufficient seed sources are lacking.

12B4. Monitor and evaluate the effectiveness of strategies for increasing ponderosa pine habitats. Monitor focal wildlife and fish populations to measure responses to ponderosa pine habitat improvements. Modify strategies as necessary.

Discussion: As discussed in the previous objective, coverage by ponderosa pine forests in the subbasin has declined, primarily due to the influence of fire suppression and timber harvest. Management for the restoration of ponderosa pine to areas of historic dominance and encouragement of natural succession processes will increase the amount of ponderosa pine habitats (and eventually mature ponderosa pine habitats) available to dependent wildlife.

Problem 13: Changes in the disturbance regime and resulting structural conditions (primarily due to fire suppression and timber harvest) of the forested habitats of the Snake Hells Canyon subbasin have negatively impacted native terrestrial species that depend on these habitat types.

Objective 13A: Restore the composition and structure of forests to within the historic range of variability (HRV).

Strategies:

13A1. Map, inventory, and prioritize for protection existing old growth and potential old growth areas. Determine historic range of variability of old growth communities based on habitat type and compare to existing condition.

13A2. Restore old growth—Where the historic fire regime consisted of frequent and repeated underburns, use understory thinning and prescribed burning to encourage the establishment of old growth habitat in areas where old growth is below the historic range of variability.

13A3. Protect existing old growth habitat and associated KECs through land purchase, fee title acquisitions, conservation easements, land exchanges, or other strategies.

13A4. Use appropriate management techniques to restore early seral species when appropriate based on historic range of variability.

13A5. Use appropriate management techniques to return areas to nonlethal fire regime. Use fuel model, vegetation, and structure maps to prioritize areas outside the historic range of variability for treatment.

13A6. Monitor and evaluate efforts to restore forest communities to the historic range of variability, modify strategies as necessary. Monitor focal wildlife and fish populations to measure responses to changes in forest stand structure and habitat improvements.

Discussion: The distribution and abundance of forest structural conditions in the subbasin is outside the range of what occurred historically. This situation is primarily a result of changes in the disturbance regime that have occurred due to timber harvest and fire suppression (see assessment sections 1.7.10 about fire suppression and 3.5.10 about environmental conditions for details). These changes have decreased the suitability of the subbasin to many species adapted to native structural conditions (see assessment section 4.2.2 for details).

Where timber harvest has occurred in the subbasin, most forests are deficient in the late and old structural stages and associated KECs (snags, hollow boles, etc.). Recent assessments conducted by the BLM and USFS both found that mature and early seral age classes were below what would have been present historically across most of the analyzed landscape (BLM 2002, USFS 2003). Mid-seral structural conditions were more prominent than what would have occurred historically under natural disturbance regimes. Forest habitats in areas (e.g., portions of Craig Mountain) where heavy timber harvest has occurred in the subbasin are fragmented with smaller patch sizes than would have been present historically. Fire suppression has resulted in increased accumulation of fuels, higher vegetation densities, and a major shift in species composition and size class distribution of trees. The accumulation of duff, as well as increased density of vegetation and fuels, has created conditions in which even light-severity fires can be damaging due to the concentrated heating of the tree bole. The accumulation of ground fuels along with denser, multistoried stand conditions has also created "fuel ladders" that cart fire into the tree canopy, resulting in high intensity crown fires. Unlike the moderate-severity fires that burned historically, many wildfires now have the potential to impact soil productivity and increase erosion through the consumption of organic matter and high temperature that may result. In mid-elevation forests, fire exclusion and other factors (e.g., timber harvest) have resulted in a shift from young and old single-layer stands dominated by shade-tolerant tree species (e.g., Douglas-fir and grand fir). The development of dense, multilayered stands has resulted in larger, more frequent stand-replacing fires and a greater susceptibility to insects and disease. Higher fuel loads also increase the potential for soil heating and higher mortality of trees and understory vegetation. The net result is wildfires that are more severe and more difficult to control (BLM 2002).

Exclusion of fire as a forest process has significantly changed wildlife habitat conditions. Lack of areas with fire-killed or weakened trees has impacted the

black-backed woodpecker and other snag-dependent species in some areas. Thinning effects of ground fires has allowed shade-tolerant tree species to crowd out important forage plants and compete for moisture and nutrients, discouraging the growth of large trees and maintenance of old growth conditions (BLM 2002). Due to dense forest conditions, the possibility of large stand-replacing fires is now greater than it was historically. These types of fires can negatively impact wildlife species that require mature stands or associated KECs. Large fires result in a more homogenous distribution of structural conditions and can reduce the diversity of species an area can support. The above strategies strive to restore the subbasin to more natural disturbance regimes, which will begin to move forest structural conditions and compositions in the subbasin back within the HRV and provide more suitable habitat conditions for native wildlife that are adapted to these natural forest conditions (see assessment sections 1.7.10, 3.5.10, and 4.2.2 for details).

Problem 14: Road construction has altered the size, quality, distribution, and spatial relationships in and between habitat patches in the subbasin.

Objective 14A: Reduce the impact of the transportation system on wildlife and fish populations and habitats.

Strategies:

14A1. Develop and implement an interagency travel plan to decommission or institute closures on roads not critical for transportation, recreation, and land management activities that are most negatively impacting terrestrial and/or aquatic habitats.

14A2. Continue efforts to identify and refine delineation of important big game summer and winter range. Use this information in the development of a travel plan to reduce the impact of human disturbance on big game.

14A3. Establish effective enforcement of road closures and seasonal use restrictions.

14A4. Monitor and evaluate efforts to reduce the impact of roads and road usage on the fish and wildlife populations of the subbasin. Modify implementation strategies as necessary.

Discussion: Roads have been documented to have numerous negative effects on fish and wildlife populations. Wisdom et al. (2000) identified 13 factors consistently associated with roads in a manner deleterious to terrestrial vertebrates (see assessment section 4.2.2 for details). Even though road densities in the subbasin are relatively low, the transportation system of the Snake Hells Canyon subbasin may be a limiting factor to wildlife populations in some areas. Based on classes used by the Wallowa–Whitman National Forest to determine the likely impact of

roads on wildlife sensitive to open roads, high-impact areas occur only in the most downstream portion of the subbasin in the area adjacent to Lewiston. Moderate areas are most concentrated in downstream portions of the subbasin including the Tenmile, Redbird, Captain John, and Corral North drainages, but they also occur in more remote portions of the subbasin including the Kirkwood, Corral South, Wolf, and Divide drainages. Density is not the only road-related feature that can affect fish and wildlife. A single road that is restricting a road channel or is a major source of sediment in an important spawning area may be a greater management concern than a subwatershed with high road densities. Roads that impact wildlife populations by providing access during the breeding or hunting season may not cause problems at other times of year. In these types of cases, seasonal closures may resolve the problem. The USFS and other land management agencies in the subbasin identify roads that are posing a threat to the subbasin's fish and wildlife resources and impose restrictions, make closures, or have roads removed. Coordinating these efforts across the subbasin will maximize benefits to fish and wildlife populations, while maintaining access and recreational opportunities (see assessment section 4.2.2 for details).

Problem 15: The hydropower system has caused a nutrient deficit in the subbasin by restricting the flow and delivery of nutrients downstream and by reducing anadromous fish runs through and into the subbasin. This nutrient deficit has negatively impacted the subbasin's wildlife and fish populations.

Objective 15A: Restore natural nutrient cycles or mitigate for damages to aquatic and terrestrial populations due to the loss of these nutrients.

Strategies:

15A1. Assess nutrient inputs and cycling in the Snake Hells Canyon subbasin. Prioritize areas for restoration of nutrient loads.

15A2. Quantify the impacts of nutrient reductions on wildlife populations caused by the construction and continued operation of the hydropower system.

15A3. If nutrient levels are demonstrated to be limiting to wildlife, investigate alternatives to restore natural nutrient levels to the subbasin. Integrate with nutrient restoration efforts, when possible, to benefit both aquatic and terrestrial species.

15A4. Monitor and evaluate efforts to restore nutrients to upland areas. Monitor focal fish and wildlife to assess population response to changes in nutrients. Integrate new information into effort and revise strategies as needed.

Discussion: The flow of nutrients into the subbasin has been altered by the construction of the Hells Canyon Dam and the reduction of anadromous fish runs through the subbasin. The reduction of these nutrient flows has potentially impacted numerous wildlife species and the subbasin's ecosystem as a whole. For example,

94 of the wildlife species with habitat in the subbasin have been demonstrated to have a relationship to salmon; 25 of these species are concern or focal species (see assessment section 4.2.2 for details). Quantifying the impact of reduced nutrient inputs into the subbasin will allow for a more in-depth understanding of ecosystem processes and more effective management of the subbasin's resources. Maintaining and enhancing salmon runs in the subbasin through implementation of strategies outlined in objectives 1A, 2A, 3A, 8A, 8B, 8C, 11A, and 11B will be critical for restoring natural nutrient cycles. Other options include the development of innovative technologies to reduce the impact of upstream hydropower on nutrient inputs or the addition of salmon carcasses or other nutrient sources to the subbasin.

5.2.3 Socioeconomic Components

These social and economic objectives are designed to provide operational guidance for implementing the terrestrial and aquatic protection and restoration objectives and strategies outlined in the management plan. These are operational objectives and strategies essential to the short- and long-term success of overall efforts in the subbasin. The problem statements and socioeconomic objectives were developed to address factors limiting the successful implementation of the vision in the Snake Hells Canyon subbasin. They are not meant to be optional or to be implemented to the detriment of aquatic and terrestrial objectives and strategies. Instead, they are to be integrated into the implementation process and addressed whenever possible as part of all planning and implementation activities. These objectives address important aspects of the socioeconomic context for aquatic and terrestrial protection and restoration. The successful management of fish and wildlife in the subbasin is partially dependent on implementing the strategies detailed in this section.

Problem 16: As reflected in the inventory, numerous agencies and entities are implementing programs and projects in the subbasin. A lack of local support and understanding can undermine long-term implementation success. Coordination and integration can be improved to benefit economic, social, cultural, and biological aspects of aquatic and terrestrial protection and restoration in the subbasin.

Objective 16A: Improve coordination of activities in the subbasin to promote stewardship of natural resources and increase long-term implementation success.

Strategies:

16A1. Form a group focused on fish and wildlife planning and implementation to prioritize and coordinate activities in the subbasin. Identify an entity to initiate this group.

16A2. Involve local stakeholders in finer-scale planning efforts (e.g., watershed or reach) and in program and project planning.

16A3. Organize project goals and implementation strategies and coordinate plan implementation with federal, tribal, state, local, and other interests to avoid program and project duplication.

16A4. Implement information and education actions identified in this management plan. Provide opportunities for subbasinwide information distribution, such as periodic public meetings, newsletters, websites, etc.

16A5. Develop an ongoing public involvement process.

Discussion: The effort to implement this plan will be a complex and time-intensive task requiring efforts at multiple scales and in multiple political and funding forums. Systematic coordination of programs and plans in the subbasin will achieve benefits beyond the value of an individual program or project and will promote the application of ecosystem management principles. Existing programs and projects are listed in the inventory.

A number of regional processes provide forums for making management decisions about the Hells Canyon reach of the Snake River. IPC is in the process of relicensing the Hells Canyon Complex, and water quality and habitat issues involving impacts of the Hells Canyon Complex are being negotiated through the FERC process. Both the FERC process and the subbasin planning process address impacts of the hydropower system on fish and wildlife resources. This overlap provides opportunities for coordination on research, monitoring, and implementation activities in the Snake Hells Canyon subbasin. The need exists to incorporate information from other processes and to update information in subbasin planning based on outcomes in these other forums. Similar coordination is needed with other important processes such as TMDL processes, implementation of the HCNRA *Comprehensive Management Plan*, and other ongoing management processes.

Planning efforts for this subbasin need to be incorporated into the planning and management forums for out-of-basin issues. This includes participating in province- and basinwide coordinated studies and water management forums to examine mainstem and ocean impacts. In addition, this subbasin planning effort provides a needed opportunity to examine and plan management activities for the uplands and small tributary habitat in the subbasin across multiple jurisdictions (three states, etc.). This effort provides an opportunity to coordinate uplands and small tributary management with mainstem management.

Improved subbasin-scale coordination will enable the development of synergistic benefits, as well as providing the communication necessary to identify and avoid duplication of efforts and to allow for more efficient and effective use of limited resources. For long-term success, the Planning Team expressed the need to develop an organization to represent a broad cross section of stakeholders, agencies, and tribes active in the Snake Hells Canyon subbasin. This group would include but not be limited to representatives of tribes, local, state, and federal agencies; private individuals; local interest groups; and landowners. This subbasin-scale organization will provide administrative coordination for implementing the habitat portions of the subbasin plan, as well as coordinating technical resources and education and public involvement activities. This group

can represent efforts in the subbasin as a single coordinated effort to funding sources and regional management entities. Early involvement of many of the interested parties will help to avoid conflicts later in the process.

Over the long run, broad public understanding and commitment to fish and wildlife efforts need to be developed in the Snake Hells Canyon subbasin. Technical resources need to be provided to local groups, while local data, information, and priorities need to be integrated into the subbasin-scale effort. A sustained, long-term effort to provide information to communities and residents of the subbasin must be maintained indefinitely. These activities should be woven into projects and programs when possible. Multiple roles and efforts should be underway at the same time. Programs and project proposals need to be developed that are compatible with existing community needs and that integrate with local watershed protection, restoration, and management objectives and activities in the subbasin.

Problem 17: The management of both public and private lands and water in the Snake Hells Canyon subbasin impacts surrounding communities and their economies.

Objective 17A: Consider benefits and negative impacts to surrounding communities, their economies, and fish and wildlife.

Strategies:

17A1. Identify impacts of implementing this plan on surrounding communities.

17A2. Balance impacts on the communities surrounding Hells Canyon and their economies while achieving sustainable aquatic and terrestrial populations.

17A3. (Subbasin-scale group formed in strategy 16A1) Evaluate the economic efficiency and impacts of projects as part of the subbasin-scale prioritization processes in the subbasin.

17A4. Balance benefits to aquatic and terrestrial resources of management activities on recreation when possible.

17A5. To maximize benefits, utilize local labor forces, contractors, and suppliers whenever possible while implementing habitat improvement projects.

Discussion: Recreation and tourism are an increasingly important part of the economic sector (see assessment sections 1.6.1 and 1.7.2). The majority of the Snake Hells Canyon subbasin is publicly owned, with nearly half under USFS management (see assessment section 1.5.1).

Recreation, which includes fishing, hunting, boating, tourism, and ecotourism, is economically important in the subbasin and surrounding communities. Recreational use in the Craig Mountain area is estimated at 32,000 visits per year (BLM 2004), with the majority of the visitors pursuing wildlife-related activities.

Big game, upland game, and turkey hunting, in addition to wildlife viewing, are the primary activities. Visitors participate in recreational activities that include mushroom picking, ATV riding, snowmobiling, picnicking, horseback riding, mountain biking, and hiking. Nonmotorized and motorized boating is very popular on the Snake River. The summer floating season and fall steelhead seasons are the most popular times for recreation in the subbasin.

Grazing is an important natural resource use in the subbasin with important economic and multigenerational cultural traditions, and the impacts of any plans or programs must be considered. Many BMPs are widely accepted as general strategies. Short-term goals need to be realistic and achievable. Projects that improve the timing, duration, and intensity of grazing along with distribution of livestock will benefit ranchers as well as aquatic and terrestrial species and habitats. These need to be developed in concert with livestock producers, allowing enough time in the process to permit successful transitions without major operational impacts. Livestock producers are not opposed to proper grazing practices, but they are opposed to rapid, sudden, required shifts in policy that do not allow them time to adjust operations with minimum disruption and economic consequences. Many BMPs have been completed in the subbasin, but there is still room for additional projects.

Community support is critical to the success of long-term program and project implementation. In addition to identifying economic benefits to local communities from implementing this plan, an ongoing public involvement process needs to integrate local groups and individuals in the decision-making process and provide them with educational resources to understand management activities and their rationale. Whenever possible, local labor and resources should be involved in protection and restoration efforts to provide direct participation in the process while providing work and economic benefits to local areas.

Problem 18: Many important cultural uses of the Snake Hells Canyon subbasin are impacted by aquatic and terrestrial management. Indian tribes are continually losing opportunities to practice long-standing traditions that keep their cultures alive—traditions related to and contingent on responsible natural resource management. Non-Indian users also face difficulty in maintaining important cultural uses in the subbasin. Local industries that support these users suffer or benefit from impacts on these uses.

Objective18A: Protect and foster both Indian and non-Indian cultural uses of natural resources in the Snake Hells Canyon subbasin.

Strategies:

18A1. Integrate information on important Indian and non-Indian cultural practices into planning and implementation activities.

18A2. Provide information and education on important Indian and non-Indian cultural practices to land managers, regulatory agencies, and policy makers.

Discussion: Healthy fish and wildlife populations provide economic and cultural benefits to Indian and non-Indian users in the Snake Hells Canyon subbasin. The economy of the Snake Hells Canyon subbasin is highly dependent on natural resources, including both the availability of those resources and their preservation.

In addition to economics, social values need to be incorporated when implementing activities. General changes to natural resource and public land management in the Snake Hells Canyon subbasin impact traditions and cultural uses of the land, water, and resources. The living culture of the Indian tribes in the Snake Hells Canyon subbasin heavily relies on the continued opportunities to harvest the natural resources managed on public lands. The protection of treaty rights and cultural traditions is a key component of public land management.

Non-Indians also have important traditional cultural uses of public lands that need to be protected and fostered. Recreation is important to the communities and economies in and around the subbasin. Hunting, fishing, boating, hiking, ecotourism, and archaeology make Hells Canyon an important recreation center in the Northwest. These activities not only provide economic benefits for the area, but for many people, they represent important cultural traditions in their own right.

6 Research, Monitoring, and Evaluation Plan

6.1 Ecological Management Framework

This section describes conditions identified in the *Snake Hells Canyon Subbasin Management Plan* that will require research, monitoring, and evaluation (RM&E) activities to aid in resolving management uncertainties and allow for effective adaptation of management practices when necessary. This RM&E section is closely related to the objectives and strategies described in section 5 of this subbasin management plan. These objectives and strategies were developed to address the limiting factors identified in the *Snake Hells Canyon Subbasin Assessment* and promote the vision for the Snake Hells Canyon subbasin (see section 4).

The need for adaptive management and monitoring and evaluation of project implementation was an issue of focus during the development of the objectives and strategies. Each objective has a set of strategies focused on either gaining further understanding of the limiting factors or taking actions to improve or correct the limiting factor. Each objective also has a strategy focused on evaluating the effectiveness of these strategies in obtaining the objective and modifying the approach taken to achieve the objective as necessary. To effectively assess the effectiveness of a strategy, data on the impact of implementing the strategy on the environmental conditions or the understanding of environmental conditions in the subbasin will need to be collected throughout its implementation. This section seeks to guide the collection of the most appropriate data to allow for effective adaptive management.

The development of this RM&E section was guided by a series of meetings with technical personnel representing various tribal, federal, state, and county agencies involved in the management of fish and wildlife resources in the Snake Hells Canyon subbasin. The group reviewed the guidance in the *Technical Guide for Subbasin Planners* (NPPC 2001) and incorporated the elements they considered appropriate and feasible based on the projects timeline, the needs of the subbasin, and the current state of knowledge in the subbasin. The group attempted to develop an integrated and iterative monitoring and evaluation plan that is consistent with the three-tiered system advocated by the ISRP (2003) and the Columbia Basin Fish and Wildlife Authority's (CBFWA) Collaborative Systemwide Monitoring and Evaluation Project (CSMEP). The three tiers integral to this type of RM&E plan are described below as they were defined by the ISRP in its 2003 review of the *Draft Clearwater Subbasin Management Plan* (ISRP 2003). The three tiers and their relationship to adaptive management are illustrated in (Figure 1).

Tier 1 (trend or routine) monitoring obtains repeated measurements, usually representing a single spatial unit over a period of time, with a view to quantifying changes over time. Changes must be distinguished from background noise. In general, Tier 1 monitoring does not establish cause and effect relationships (i.e., is not research) and does not provide statistical inductive inferences to larger areas or time periods (ISRP 2003).

Tier 2 (statistical) monitoring provides statistical inferences to parameters in the study area as measured by certain data collection protocols (i.e., the methods in a report). These inferences apply to areas larger than the sampled sites and to time periods not studied. The inferences require both probabilistic selection of study sites and repeated visits over time. Individual

proposals can support larger Tier 2 statistical monitoring projects such as the Oregon plan by using the same field methods to select study sites that contribute information to Tier 2 statistical monitoring. Most large projects should implement sampling designs that allow Tier 2 statistical monitoring or contribute data to statistical monitoring (ISRP 2003).

Tier 3 (research) monitoring is for those projects or groups of projects whose objectives include establishment of mechanistic links between management actions and salmon or other fish or wildlife population response. Bisbal (2001) defines this level of effort as *effects* or *response monitoring*, the repeated measurement of environmental variables to detect changes caused by external influences. The key words here are "establishment of mechanistic links" and "detect changes caused by external influences." Tier 3 research monitoring requires the use of experimental designs incorporating "treatments" and "controls" randomly assigned to study sites (ISRP 2003).

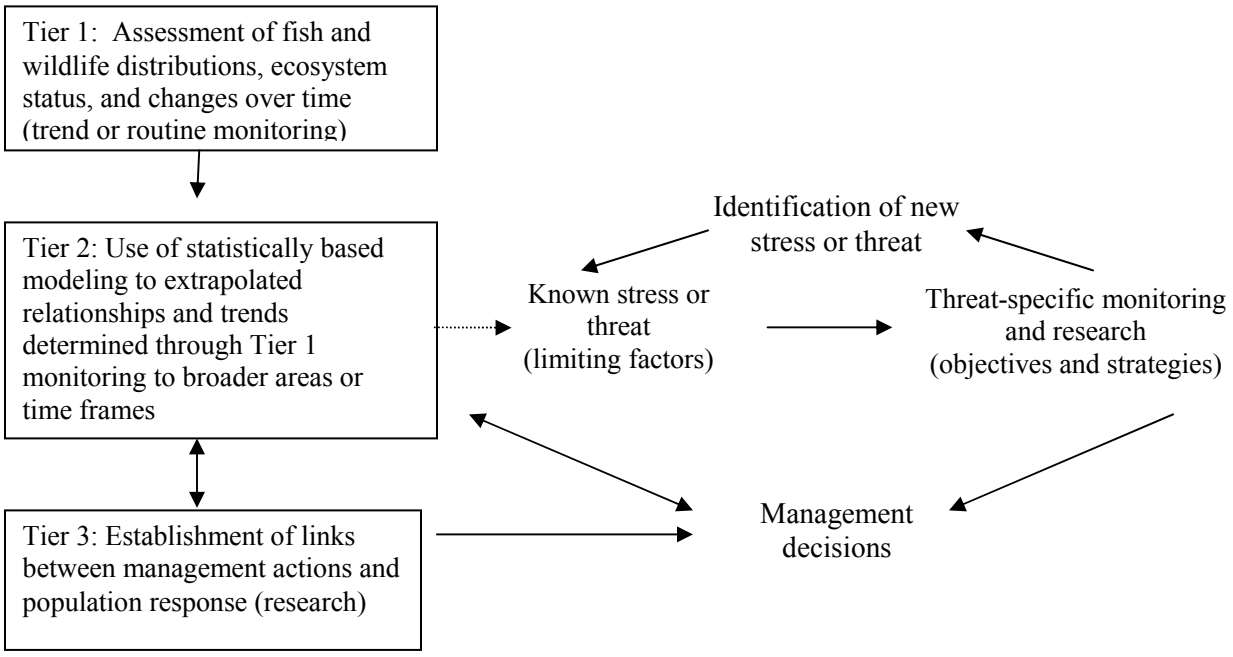

Figure 1. The three tiers of an RM&E program and their relationship to the adaptive management feedback loop.

In the context of a subbasin plan, RM&E is needed to 1) ensure that strategies selected and implemented are addressing the limiting factors as anticipated and 2) verify that the limiting factors identified in the assessment are, in fact, the elements that are limiting the environmental expression and biological performance desired. The RM&E plan is structured around the objectives and strategies section. In that section, three main types of strategies were identified for achieving the objectives and improving the limiting factors in the subbasin: strategies focused on filling data gaps, addressing research needs, or implementing actions to improve or preserve conditions. The types of data that will need to be collected to assess the successfulness of each

strategy in contributing to meeting the objective will vary among the three above-mentioned types of strategies. Additionally, the amount of information available to the Technical Teams to make these recommendations varied among the three types of strategies.

6.2 Data and Information Gaps

The following lists include specific data and information gaps defined by the Aquatic and Terrestrial Technical Teams needed for management within the Snake Hells Canyon subbasin (Table 6). Data and information gaps represent a hindrance to effective management of the fish and wildlife resources of the subbasin. In most cases, these gaps are in the basic understanding of species or habitat distribution, condition, and trends. While it would be possible and probably worthwhile to develop research projects focused on closing many of these data gaps, in general they do not fit the criteria of a classic research need. (Research needs are delineated separately in section 6.3.) For each data gap, the Technical Teams identified potential, generalized methods for collecting data. Specific methods to be used will necessarily be defined in individual project proposals to account for spatial scales, temporal and monetary restrictions, and specific goals of the proposed work.

Table 6. Data and information gaps limiting management efficiency of aquatic terrestrial ecosystems in the Snake Hells Canyon subbasin, as identified in section 5.2 of this plan.

Strategy		Potential Methods	Outcomes
Aquatic Management Data and Information Gaps			
3A3	Identify and prioritize primary limiting factors by migratory species life stage. Identify areas for protection as well as restoration using the information in assessment section 4.1.4 as a starting point.	Species- and life stage-specific ecological assessment	Prioritized, species- and life stage-specific limiting factors definition
3B1	Evaluate needs and opportunities to increase native resident fish populations by 2010.	Field surveys Ecological and habitat assessment	Identified needs and opportunities
3B3	Investigate possibilities for, and positive and negative biological and economic impacts of, enhancing fish passage.	Ecological and social assessment	Increased knowledge of biological and economic impacts of enhanced fish passage
3B4	Obtain and document information on ways to minimize the impacts of barriers and the biological benefits of enhancing passage.	Field surveys GIS mapping Ecological assessment	Increased knowledge of barrier impacts
8A2	Identify flow-related limiting factors for fish, wildlife, and riparian habitat and identify actions to address limiting conditions at finer scales than presented in the assessment.	Field surveys Research Ecological assessment	Increased understanding of and ability to manage flow concerns
8A4	Determine effects of Lewiston Orchards Irrigation District diversion on flow in Captain John Creek and protect fish from any negative impacts.	Field surveys Ecological assessment	Improved understanding of impacts of localized water diversion and possible improved habitat condition
8A5a	Develop estimates of minimum flows needed to support fish, hydrologic function, and riparian function in tributaries.	Field surveys Research Ecological assessment	Ecologically based estimates of necessary minimum flows

Strategy		Potential Methods	Outcomes
8B1	For the tributaries—Inventory and prioritize areas where temperature is most limiting to target species. Conduct habitat inventories in priority areas of the subbasin, placing emphasis on canopy closure/stream shading data collection. Develop a water temperature database for the subbasin. Prioritize causes for temperature exceedances, actions to address temperature problems, and project areas. Prioritization needs to consider cost effectiveness and potential biological responses. This prioritization will determine sequencing of activities in strategies 8B2 and 8B3.	Ecological assessment Field surveys Habitat inventories Research	Increased understanding of and ability to manage temperature concerns
8B2	For the tributaries—Identify riparian, wetland, and floodplain areas where degraded conditions contribute to high summer temperatures.	Ecological assessment Field surveys Research	Increased understanding of and ability to manage temperature concerns
8B5	For the tributaries—Identify additional sources of temperature exceedances. Implement existing and develop new TMDLs, EAWSs, and other watershed-scale assessments to define localized factors negatively influencing temperature regimes. Differentiate between natural and anthropogenic influences. Add existing information to database.	Ecological assessment Field surveys	Increased understanding of and ability to manage temperature concerns
8C1	Identify problems and actions to address sediment problems. Implement existing and continue to develop TMDLs, EAWSs, and other watershed-scale assessments designed to define sediment sources and actions aimed at reducing or eliminating sediment impacts.	Ecological assessment Field surveys	Increased understanding of and ability to manage sediment concerns
8C2	Develop a coordinated sediment production, transport, and fate monitoring program through existing monitoring entities where possible.	Interagency coordination Ecological assessment Research	Increased understanding of and ability to manage sediment concerns
Terrestrial Management Data and Information Gaps			
4A1	Collect data—Develop a subbasinwide survey program and database for terrestrial focal species, ESA-listed species, sensitive species, Neotropical migrant species, culturally important species, amphibians, bats, and rare plant species.	Use methods appropriate to species accepted by the scientific community	Improved management and conservation of plant and animal populations
4A2	Improve the documentation and data-sharing efforts of the Idaho Conservation Data Center, Oregon Natural Heritage Program, and Washington Natural Heritage Program within the subbasin.	Relational databases appropriate reporting forms	Increased knowledge of the distribution of rare species and improved management ability

Strategy		Potential Methods	Outcomes
9A1	Identify and prioritize native plant communities and rare plant populations for protection from exotic weeds using this and other plans, county weed boards, or other sources that provide weed information. Prioritize by expected biological response, community rarity, and uniqueness.	Field surveys GIS mapping Habitat typing Ecological assessment	Identification and protection of highest quality habitats
9B1	Prioritize for treatment—Identify and prioritize noxious weed infestations for treatment in cooperation with existing efforts in the subbasin (see inventory sections 3.1, 4.1 and 5.1). Prioritize according to cost effectiveness, expected biological response, community rarity, and uniqueness. Integrate new information with existing inventories and management efforts.	Field surveys GIS analysis and mapping Noxious weed infestation risk assessment	Best biological response for noxious weed fighting effort
10A1	Continue to inventory, map, and establish the condition of grassland habitats within the subbasin.	Field surveys GIS mapping Habitat typing Ecological assessment	Identification and protection of highest quality habitats
10A2	Identify priority grassland areas for protection—Give priority to larger intact remnants and those that contain rare species.	Field surveys GIS mapping Habitat typing Ecological assessment	Identification and protection of highest-quality habitats
11A1	Identify and prioritize riparian habitats for protection and restoration. Give highest priority to riparian habitats supporting spawning and rearing for anadromous and native resident salmonids or providing current or potential habitat for mountain quail (see assessment sections 3.4 and 3.5.6)	Field surveys GIS mapping Habitat typing Ecological assessment	Identification and protection of highest quality habitats
11A5	Identify and prioritize tributary riparian habitat areas for improvement as mitigation for impacts of hydropower system-induced water fluctuations on mainstem riparian habitat	Comprehensive riparian inventory	Improved ability to mitigate for hydropower-related habitat losses
11B1	Fund the efforts of the USFWS and collaborators to finalize and digitize National Wetlands Inventory maps across the subbasin.	Hydric soils maps, aerial photos, NWI	Biodiversity and increased habitat available to wetland-associated species
11B2	Inventory, assess functionality, and prioritize for restoration or protection the wetlands, seep, spring, and wet meadow habitats of the subbasin. Use importance to wildlife (for example, hibernacula for amphibians) as a major criterion in the prioritization process.	Field surveys GIS mapping Water quality assessments	Identification and protection of highest-quality habitats

Strategy		Potential Methods	Outcomes
12A1	Continue efforts to inventory and map existing mature ponderosa pine habitats.	Satellite imagery and aerial photo interpretation Field surveys Basal area	Effective management of ponderosa pine habitats and their associated species
12A2	Identify mature ponderosa pine communities for protection—Prioritize larger remnants and those with highest potential to be lost or degraded.	Field surveys GIS mapping Basal area	Identification and protection of highest quality habitats
12B1	On sites where ponderosa pine would have historically been dominant but are now absent or reduced, identify and prioritize areas to develop into ponderosa pine communities.	Field surveys GIS mapping Habitat typing Comparison to HRV	Return to more natural forest conditions
13A1	Map, inventory, and prioritize for protection existing old growth and potential old growth areas. Determine historic range of variability of old growth communities based on habitat type and compare to existing condition.	Field surveys GIS mapping Habitat typing Comparison to HRV	Identification and protection of highest quality habitats
14A2	Continue efforts to identify and refine delineation of important big game summer and winter range. Use this information in the development of a travel plan to reduce the impact of human disturbance on big game.	Field surveys GIS mapping Habitat typing	Identification and protection of big game winter range

In addition to the data and information gaps identified within management plan strategies (presented in Table 6), additional specific data and information gaps related to aquatic resources were identified throughout the subbasin assessment. The following highlights these additional data gaps, which may or may not be specifically identified in management plan strategies:

1. No substantive information exists regarding the distribution, life history, capacity, or trends of mollusk populations within the Snake Hells Canyon subbasin.

2. No information was located regarding past or present levels of tribal, sport, or incidental harvest of spring or fall chinook salmon, white sturgeon, bull trout, redband trout, or Pacific lamprey within the Snake Hells Canyon subbasin.

3. Very limited quantifiable information was available regarding sport harvest of steelhead within the Snake Hells Canyon subbasin; available information does not reflect recent harvest. No information was located regarding past or present levels of tribal or incidental harvest of steelhead within the Snake Hells Canyon subbasin.

4. It is unclear to what degree, if any, downriver commercial and/or localized harvest for bait impact Pacific lamprey populations within the Snake Hells Canyon subbasin.

5. No information is available regarding carrying capacity of steelhead, bull trout, redband trout, white sturgeon, or Pacific lamprey within the Snake Hells Canyon subbasin.

6. No information is available regarding genetic integrity of Pacific lamprey, bull trout, redband trout, or white sturgeon within the Snake Hells Canyon subbasin.

7. No information regarding habitat conditions specific to redband trout was located for areas within the Snake Hells Canyon subbasin.

8. No information is available regarding the numerical abundance or trends of redband trout, bull trout, or Pacific lamprey populations within the Snake Hells Canyon subbasin.

9. No information is available regarding productivity of redband trout, spring chinook salmon, steelhead, Pacific lamprey, bull trout, or white sturgeon within the Snake Hells Canyon subbasin.

10. No information exists on the relationship between habitat capacity and productivity within the Snake Hells Canyon subbasin.[2]

6.3 Research Needs

A variety of research needs were identified during development of this subbasin plan (Table 7). In most instances, the broad nature of identified research needs will likely result in the

[2] This information gap was identified through Aquatic Technical Team discussion. It is not directly stated in the subbasin assessment but may be inferred by the lack of capacity and productivity information in the assessment for most species.

delineation of multiple focused research projects that, when results are combined, will address the overall need. For this reason, details regarding research methods (e.g., sampling frequencies and protocols, experimental design, and statistical analysis) were not delineated and should be addressed in individual project proposals focused on addressing individual components of the identified research needs.

Given this situation, different approaches were taken by the Aquatic and Terrestrial Technical Teams in developing information for Table 7. Both teams attempted to delineate the anticipated spatial scale at which the research needs would most likely be addressed and the temporal scale anticipated to be necessary for addressing each identified need.

For aquatic research needs, potential research hypotheses are presented for each identified need (Table 7). However, hypotheses are developed for stated research needs that are often too broad to logically be conducted as a single research project under a single hypothesis. Stated hypotheses are intended to help with interpretation of the research need and intent, but they should not be viewed as rigid. Projects proposed to address these research needs should clearly define new or additional hypotheses as necessary to address specific components of the identified research need.

The Terrestrial Technical Team felt that, since needs are so broad in scale and pervasive, it was not feasible to develop testable hypotheses within the time frame of this project. Instead, the Terrestrial Technical Team focused on expected outcomes and benefits of addressing identified research needs (Table 7). The intent, however, is consistent with that of the Aquatics Technical Team, which is to provide information to aid in interpretation of the research need.

Table 7. Aquatic and terrestrial research needs in the Snake Hells Canyon subbasin identified as strategies to achieve biological and environmental objectives.

Strategy		Null Hypothesis (Aquatic)[1] or Expected outcomes (Terrestrial)	Spatial Scale	Project duration
Aquatic Research Needs				
1A1	Investigate creative measures to allow future modifications to operations. Identify and prioritize most effective measures (relative to biological impacts).	Biological utility of the Snake River below Hells Canyon Dam is not a function of dam operations.	Mainstem	Three to five years
2A3 and 3A1	Conduct research within the context of identifying and prioritizing management versus basinwide environmental effects.	Undefined	Basin/Subbasin	Four generations or twenty years
2A4	Continue to develop stock-specific knowledge of interactions between hatchery and wild fish.	Hatchery and wild fish do not interact within or between species. and There are no negative consequences of interactions between hatchery and wild fish in the subbasin.	Subbasin	Five to ten years
2A5	Conduct research on Pacific lamprey life history, abundance/distribution, and productivity within the subbasin.	Undefined	Subbasin/reach	Three to five years for abundance and distribution; multiple generations for other factors
3A2	Evaluate and quantify the loss of prey for white sturgeon within the subbasin. Determine the effect of loss of prey on white sturgeon.	The amount, quality, and distribution of prey for white sturgeon in the subbasin have not been altered by reductions in anadromous fish runs.	Mainstem	Three to five years

Strategy		Null Hypothesis (Aquatic)[1] or Expected outcomes (Terrestrial)	Spatial Scale	Project duration
3A5	Identify or develop indices to evaluate biological response(s) to habitat improvement projects, using appropriate fish production models or empirical data to link the developed index to fish production potential.	Habitat improvement cannot be used to predict biological response	Subbasin/reach	Four generations or twenty years
3B3	Investigate possibilities for, and positive and negative biological and economic impacts of, enhancing fish passage.	Existence of natural and artificial barriers does not impact persistence, productivity, abundance, or genetic interchange of native species within Snake Hells Canyon subbasin. and Increasing fish passage to/from the Hells Canyon reach will not have significant economic impacts.	Subbasin	Three to five years
8A1	Determine adequate flows and habitat suitability indices for specific life history stages of all focal fish species.	Species and age composition of fish populations in the subbasin is not defined by flow levels	Subbasin	Five years
8B7	For the mainstem—Investigate creative measures to allow future modifications to Hells Canyon Dam operations. Identify and prioritize most effective measures (relative to temperature concerns).	Thermal regimes cannot be altered by Hells Canyon Dam operations	Mainstem	Three to five years
Terrestrial Research Needs				
4A3	Continue existing and expand research on the population dynamics habitat requirements and key environmental correlates (KECs) of the terrestrial species of the Snake Hells Canyon subbasin. Focus research on focal, ESA-listed, and culturally important species and their interrelationships.	Increased understanding of species requirements and improved management	Subbasin and surrounding areas	Life of management plan
4A4	Continue existing and expand research on processes such as fire regimes, hydrology, plant community	Increased understanding of disturbance regimes and habitat	Subbasin and surrounding areas	Life of management plan

Strategy		Null Hypothesis (Aquatic)[1] or Expected outcomes (Terrestrial)	Spatial Scale	Project duration
	dynamics, etc., that influence the terrestrial communities of the subbasin.	requirements		
4A5	Continue existing and expand research on the biotic interactions and key ecological functions (KEFs) of the terrestrial communities of the subbasin (e.g., big game–livestock interactions).	Increased understanding of the interactions of wildlife species with each other and their ecosystem	Subbasin and surrounding areas	Life of management plan
10B1	Continue to research techniques for effectively restoring grassland habitats and reducing or eliminating noxious weeds and cheatgrass.	Increased effectiveness in restoring grassland habitats to native condition	Grassland habitats	Until effective techniques are developed
10B2	Establish the role of fire in maintaining natural grassland systems. Research its potential as a restoration tool.	Increased effectiveness in restoring grassland habitats to native condition Better understanding of fires role in grassland ecosystems	Grassland habitats	Until sufficient understand is achieved
12B3	Evaluate artificial regeneration as a tool for establishing ponderosa pine stands on suitable sites where sufficient seed sources are lacking.	Improved ability to restore ponderosa pine communities	Historic ponderosa pine habitats	Until effective techniques are developed
15A1	Assess nutrient inputs and cycling in the Snake Hells Canyon subbasin. Prioritize areas for restoration of nutrient loads	Improved understanding of natural nutrient cycles	Subbasin wide	Until effective techniques are developed
15A2	Quantify the impacts of nutrient reductions on wildlife populations caused by the construction and continued operation of the hydropower system.	Improved ability to mitigate for nutrient reductions caused by the hydropower system	Areas that historically received upstream nutrient inputs	Until impacts are understood

[1] Null hypotheses are developed for stated research needs that are often too broad to logically be conducted as a single research project under a single hypothesis; stated hypotheses are intended to help with interpretation of the research need and intent, but they should not be viewed as rigid. Projects proposed to address these research needs should clearly define new or additional hypotheses as necessary to achieve objectives and further achievement of the overall research need.

6.4 RM&E

Implementation or "action" strategies identified in this plan that may require monitoring and evaluation components are summarized in Table 8. The focus is on the strategy level, not on the project level. The RM&E actions described below are not intended to be a field-ready program; rather, they represent a first step in program development. Current or ongoing RM&E programs (as described in the inventory) incorporate many of the RM&E needs identified in this section. Development of new projects in the subbasin will therefore be coordinated with existing programs to maximize effectiveness, reduce redundancy, and enhance spatial and temporal data comparability.

An overview of potential short- (environmental) and long- (biological) term indicators of success around which monitoring strategies may be based is presented for each implementation or "action" strategy identified in this plan (Table 8). Similarly to information presented in the prior section, the broad nature of identified strategies will likely result in the delineation of multiple focused restoration or implementation projects that, when results are combined, will address the overall need. For this reason, short- and long-term indicators of success described in Table 8 should be considered as guidance for future project development rather than as rigidly defined indicators to be used in RM&E project components. Future projects should delineate RM&E strategies and indicators appropriate to the scale and intent of the individual project while considering the overall guidance/direction provided here to ensure that small-scale project goals and outcomes are consistent with broader-scale (subbasinwide or basinwide) goals and direction.

Table 8. Overview of strategies identified in this plan that may require monitoring and evaluation components, including description of potential short- (Environmental) and long- (Biological) term indicators of success.

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
Aquatic			
1A3 and 2A9	Monitor both the effects of limiting factors on populations and effects of restoration and management efforts aimed at minimizing impacts of limiting factors.	Population abundance and trends; trends or levels of limiting factor or related measures (e.g., temperature, shade, embeddedness, % fines).	Increased numbers of all life history stages of aquatic species
2A7	Maximize natural and artificial production effectiveness in the subbasin—Continue existing and/or implement innovative production strategies in appropriate areas to support fisheries, natural production augmentation and rebuilding, reintroduction, and research.	Increased redd counts and expanded distribution, maintaining genetic diversity	Species-specific SARs described in objective 2A are achieved
2A8	Monitor and evaluate effectiveness of implementation of artificial and natural production strategies including environmental strategies outlined in problem statements 8 through 15.	Population productivity, abundance, and trends for hatchery and natural components; harvest trends; species distribution (in relation to implemented projects).	Increased natural production and harvest of anadromous fish populations
3A7	Monitor and evaluate effectiveness of habitat improvement projects. Use indices developed in strategy 3A4 to monitor the effectiveness of habitat improvement efforts to provide biological benefits.	Environmental: As appropriate for intent of project, might include tree growth, bank stability, embeddedness, etc. Biological: Local (immediate vicinity of habitat improvement projects) and overall population abundance and trends.	Increased numbers of all life history stages of aquatic species
8A5	Implement activities to protect and improve flow in mainstem and tributaries (activities a–e)	Increased flow, more natural hydrograph[1].	Increased numbers of all life history stages of aquatic species
8B3	For the tributaries—Restore riparian functions, including wetland and floodplain areas. Continue efforts aimed at increasing streamside shading where streamside shading has been reduced by anthropogenic activities. This includes implementing forest and agricultural BMPs.	Indicators of biological and habitat condition: increased acreage of riparian and wetland habitats; more natural thermal regime and timing and increased flows; decreased equivalent clearcut area.	Increased numbers of all life history stages of aquatic species

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
8B4	For the tributaries—Restore upland watershed conditions (e.g., riparian areas) and functions (e.g., storage/recharge, flows) impacting water temperatures.	Indicators of biological and habitat condition: increased acreage of riparian and wetland habitats; more natural thermal regime and timing and increased flows; decreased equivalent clearcut area.	Increased numbers of all life history stages of aquatic species
8C4	Reduce sediment inputs by cooperatively implementing and enforcing practices that address sediment sources from logging, mining, agriculture, and other historic and current sediment-producing activities.	Indicators of biological and habitat condition: reduced cobble embeddedness, increased D50 (cobble size), reduced percent fines	Increased numbers of all life history stages of aquatic species
Terrestrial			
5A3	Prevent vandalism of bat hibernacula. Monitor and maintain the condition of existing gates and continue to add gates to protect important bat roosting and breeding areas.	Rates of bat hibernacula vandalism Number of gates installed	Improved protection of bat hibernacula Increasing trend in bat populations
5A4	Prevent the establishment of or reduce the potential impacts of introduced wildlife species (bull frog, starling) and domestic predators (cats, dogs).	Establishment and spread rates	Maintain the current low impact of introduced wildlife on the subbasin's ecosystem
5A6	When implementing the habitat strategies, incorporate the population dynamics and genetic flow issues of wildlife species in the subbasin. Prioritize actions in areas that will improve population connectivity and expand existing ranges.	Genetic flow Population isolation	Healthy and viable wildlife populations
5A7	Fund the reintroduction of appropriate native focal, sensitive, or threatened and endangered species into the subbasin where appropriate high-quality habitat is available.	Population trends for reintroduced populations	A subbasin ecosystem with all native components
6A1	Integrate mitigation developed for resource impacts from Hells Canyon Dam in the Hells Canyon Complex FERC relicensing process with the BPA/NPCC process. Protect wildlife populations and habitat through conservation easements, land acquisition, and other appropriate strategies.	Effective integrated mitigation efforts Acres of high-quality habitat available to wildlife	Increased availability of high-quality habitat for species impacted by the hydropower system

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
6A3	Recommend FERC license conditions or modifications that will reduce the impacts of the hydropower system on the wildlife populations of the subbasin.	Impacts of hydropower system to wildlife of the subbasin	Improved conditions for subbasin's wildlife populations
6A4	Monitor and evaluate effectiveness of measures in mitigating negative impacts of Hells Canyon Dam and Complex on terrestrial species.	Impacts of hydropower system to wildlife of the subbasin	Improved conditions for subbasin's wildlife populations
7A1	Protect important plant populations—Develop grazing management plans to limit adverse impacts to rare or culturally important, ESA-listed, etc., plant populations and habitat.	Successful development of grazing management plan Population trend and health of rare plant populations	Viable plant populations
7A2	Prevent seed dispersal—Minimize the potential for livestock to facilitate the spread of noxious weeds through weed-free hay programs, quarantine requirements, avoidance of grazing during periods of seed dispersal, and other actions.	Rate of noxious weed spread	Maintain high-quality native vegetative communities
7A3	Modify grazing timing and intensity to reduce the risk of erosion, soil compaction, alteration of vegetative communities, and damage to microbiotic crust.	Health of vegetative and microbiotic crust communities Erosion rates and areas of soil compaction	Stable vegetative and crust communities Reduced density of annual grasses
7A4	Reduce cattle/elk conflicts—Develop a grazing management plan to minimize cattle/elk conflicts, especially on elk winter range areas. Include the installation of off-site watering facilities where appropriate and establishment of maximum forage utilization standards for livestock on big game winter range.	Development of effective plan Rates of off site watering facilities installation Forage availability on elk winter range	Reduced conflicts between cattle and elk
7B1	Increase public and landowner education programs to improve the understanding of the threat of passing *Pasteurella* from domestic sheep to bighorn sheep.	Number of people reached	Reduced rates of outbreaks from *Pasteurella*
7B2	Eliminate area where interaction between bighorn sheep and domestic sheep is likely through grazing restrictions, land acquisition, fee title acquisitions, conservation easements, or land exchanges.	Amount of overlapping range	Reduced rates of outbreaks from *Pasteurella*

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
9A2	Prevent new infestations—Minimize ground-disturbing activities in habitats highly susceptible to weed invasion. Following disturbance, revegetate using certified weed free seed.	Extent of bare ground	Decreases in rate of noxious weed spread
9A3	Prevent seed dispersal—Provide technical assistance and develop and distribute best management practices (BMPs) to the appropriate entities to reduce the incidence of noxious weeds and nonnative plants within the subbasin. Emphasize the use of an integrated pest management strategy and implement programs and policies designed to limit the transportation of weed seeds from vehicles and livestock.	Development and implementation rates of BMPs	Decreases in rate of noxious weed spread
9A4	Seek funding for and provide technical assistance to existing weed management programs (see Subbasin Inventory), including the Idaho Weed Management Strategy and weed programs of the BLM, USFS, Nez Perce Tribe, IDFG, and other appropriate agencies.	Effective weed control programs	Decreased rates of spread and incidence of noxious weeds
9A5	Develop education and awareness programs in noxious weed identification, spread, prevention, and treatment.	Number of people reached	Decreased rates of spread and incidence of noxious weeds Fewer new invasive species
9A6	Minimize establishment of new invasive plants by developing and implementing early detection and eradication programs.	Number of new invasive plants documented in the subbasin	Fewer new invasive species and a more natural ecosystem
9B2	Treat weed infestations—Use integrated pest management principles to implement the most economical and effective treatment methods for reducing weed densities or eliminating weed populations. Use the area- and species-specific Weed Management Objectives and Priorities developed by the Cooperative Weed Management Area Committees in the subbasin.	Areas covered by invasive species Coverage by native species	Improved habitat quality for focal and concern species
9B3	Develop new, effective BMPs and inform suitable audiences about their appropriate implementation. Prioritize efforts focused on developing cost-effective methods for reducing or eliminating cheatgrass.	Development and improvement of BMPs Reductions in cheatgrass coverage	Improved habitat quality for focal and concern species

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
10A3	Protect remaining high-quality grassland habitats through land acquisition, fee title acquisitions, conservation easements, or land exchanges.	Increased acreages in protected status	Improved grassland habitats and population trends for dependent focal and concern species
10B3	On abandoned agricultural areas, plant native grasses, forbs, and shrubs that will provide food and cover for wildlife.	Acres of historic agriculture restored to native grassland communities.	Improved grassland habitats and population trends for dependent focal and concern species
10B4	Implement grazing strategies that reduce the impact of livestock on native grassland and microbiotic crust communities.	Condition of microbiotic crust communities Vegetative composition and structure	Resilient and stable grassland communities
10B5	Restore grassland habitats—Actively improve or create native grassland habitats through noxious weed control, management practices, and seeding with native species.	Coverage by native vegetation	Improved habitat quality for focal and concern species
10B6	Continue existing programs that work to acquire and restore grassland habitats. Develop new programs to acquire and restore prairie and canyon grasslands.	Effective grassland restoration programs	Improved grassland habitats for dependent focal and concern species
11A2	Protect riparian communities through land purchase, fee title acquisitions, conservation easements (including CRP, CREP, WHIP and similar habitat protection and improvement programs), land exchanges, implementation of BMPs, land stewardship, implementation of alternative grazing strategies, and installation of alternative livestock watering systems.	Implementation rates of riparian protection programsCanopy cover, vegetative diversity, understory development	Improved riparian habitat and increasing population trends for riparian-dependent wildlife
11A3	Establish riparian pasture systems, exclusion fences, off-site watering areas, or riparian conservation easements. Adjust seasonal timing of livestock grazing to minimize soil compaction, damage to vegetative communities, erosion, and noxious weed propagation.	Annual acres grazed erosion rates reduced rates of noxious weed spread	Healthy, diverse riparian habitats and streams

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
11A4	Restore continuous brushy riparian corridors from the mouth of tributary streams to forested habitats. Prioritize areas of current or historic mountain quail use or suitable habitat for mountain quail.	Structure, composition, and connectivity of riparian habitats Density of shrubs identified as important for mountain quail food or habitat	Increased distribution and numbers of mountain quail and other riparian-dependent species
11A5	Initiate protection and restoration projects to improve tributary riparian habitat to mitigate for the impacts of hydropower system-induced water fluctuations on mainstem riparian habitat.	Canopy cover, bank stability, woody debris, native species diversity, understory development Acres protected/restored vs. acres impacted	Biological diversity Resilient riparian community that supports hydropower impacted species
11A7	Increase stewardship and public knowledge—Increase understanding of the importance of riparian habitat through education programs.	Number of people contacted	Increased understanding of riparian importance and improved riparian stewardship
11B3	Improve water quality of existing wetlands through restoration activities and landowner education. Prioritize efforts based on importance to focal, sensitive, and threatened and endangered fish, wildlife, and plant species.	Water temperatures Bacteria levels Nutrient levels Sediment levels, etc.	Improved habitat quality for amphibians, fish, and other wetland-dependent focal and concern species
11B4	Protect wetland habitats through land acquisition, fee title acquisitions, conservation easements, land exchanges, public education, promotion of BMPs, implementation of the travel plan developed in objective 14A, promotion of alternative grazing strategies, and installation of alternative forms of water for livestock.	Acres of wetland protected Acres of high-quality and functional wetlands	Improved habitat quality for amphibians, fish, and other wetland-dependent focal and concern species
12A3	Protect existing ponderosa pine communities—Protect existing mature ponderosa pine communities through land purchase, fee title acquisitions, conservation easements, land exchanges, or other strategies. Encourage the planting of ponderosa pine in existing state, federal, and tribal reforestation efforts where appropriate to habitat type.	Acres of mature ponderosa pine habitat protected Acres of ponderosa pine habitat	Increased habitat quality and population trends for ponderosa pine-dependent wildlife

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
12A4	Maintain ponderosa pine communities—Where appropriate to the habitat type, use understory removal and/or prescribed burning to protect mature stands from stand-replacing fire events.	Stocking levels, structure, and condition of ponderosa pine	Increased habitat quality and population trends for ponderosa pine-dependent wildlife
12B2	Use appropriate harvest or fire treatments to recover open and two-story stands dominated by medium and large ponderosa pine.	Acres of open medium and large ponderosa pine-dominated habitats	Increased habitat quality and population trends for ponderosa pine-dependent wildlife
13A2	Restore old growth—Where the historic fire regime consisted of frequent and repeated underburns, use understory thinning and prescribed burning to encourage the establishment of old growth habitat in areas where old growth is below the historic range of variability.	Basal area Crown canopy closure Average diameter at breast height	Return of structural conditions to within HRV
13A3	Protect existing old growth habitat and associated KECs through land purchase, fee title acquisitions, conservation easements, land exchanges, or other strategies.	Acres of existing old-growth in protected status	Increased habitat availability and population trends for old growth-dependent wildlife
13A4	Use appropriate management techniques to restore early seral species when appropriate based on historic range of variability.	Quantity and distribution of early seral communities	Return of structural conditions to within HRV
13A5	Use appropriate management techniques to return areas to nonlethal fire regime. Use fuel model, vegetation, and structure maps to prioritize areas outside the historic range of variability for treatment.	Acres of forest in lethal fire regime Fuel load characteristics Fuel ladder characteristics Forest densities and strata	Return to natural fire regime
14A1	Develop and implement an interagency travel plan to decommission or institute closures on roads not critical for transportation, recreation, and land management activities that are most negatively impacting terrestrial and/or aquatic habitats.	Development and implementation of successful plan Erosion rates Wildlife security areas	Improved coordination and reduced impact of transportation system on security-dependent wildlife and other focal and concern species

Strategy		Potential Indicators to Monitor (Short Term)	Planned Biological Outcome (Long Term)
14A3	Establish effective enforcement of road closures and season use restrictions.	Number of road closure violations	Reduced resource damage and wildlife disturbance from unauthorized vehicle use
15A3	If nutrient levels are demonstrated to be limiting to wildlife, investigate alternatives to restore natural nutrient levels to the subbasin. Integrate with nutrient restoration efforts, when possible, to benefit both aquatic and terrestrial species.	Amount of nutrients added to the system Response of wildlife plant and aquatic communities to additions	More natural nutrient cycles and healthy nutrient dependent-systems and populations

7 Coordination with Existing Programs

7.1 Relationship to ESA and CWA goals

For a subbasin plan to be adopted by the NPCC, the plan must conform to existing federal guidelines of the Endangered Species Act (ESA) and Clean Water Act (CWA). The status of listed species and of water quality conditions are discussed in Assessment Sections 3.1.1 and 1.9. Planning must be reflective of, and integrated with, recovery plans for listed species within the subbasins, performance measures described in the Federal Columbia River Power System Biological Opinion, and the Water Quality Management Plan of the state (NWPPC 2001). Following is a description of ESA and CWA considerations and of how recommended objectives and strategies conform to these federal guidelines.

7.1.1 Endangered Species Act Considerations

Federally listed (threatened or endangered) species currently using or with the potential to use the Snake Hells Canyon subbasin include bull trout, spring/summer and fall chinook salmon, sockeye salmon, steelhead, Idaho springsnail, Snake River physa, bald eagle, gray wolf, lynx, Spalding's silene, and MacFarlane's four o' clock (Assessment Section 3.1.1). The Pacific lamprey, Columbia spotted frog, yellow-billed cuckoo, and Slender moonwort are currently candidate species under ESA (Assessment Section 3.1.1).

The ESA, amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS and NOAA Fisheries, as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitats.

Section 7 of the ESA also makes it clear that all federal agencies should participate in the coordination of programs that involve endangered species. Under this provision, federal agencies often enter into partnerships and memoranda of understanding with the USFWS for implementing and funding conservation agreements, management plans, and recovery plans developed for listed species. The development of these partnerships is encouraged as such planning efforts enable proactive approaches for managing listed species.

USFWS has developed, and is in the process of developing, recovery plans for species listed under the ESA in the Imnaha subbasins. Actions called for in this Management Plan should be coordinated, consistent, and integrated with these recovery plans as well any applicable performance measures from the Federal Columbia River Power System Biological Opinion (BiOp) (NWPPC 2001).

7.1.1.1 Consistency with applicable performance measures in BiOp.

The *Snake Hells Canyon Subbasin Management Plan* should be coordinated with habitat actions and ecological objectives in the Federal BiOp (N. Berwick, NOAA Fisheries, personal communication, April 4, 2004). Habitat actions described in the BiOp are intended to accelerate efforts to improve survival in priority areas in the short term, while laying a foundation for long-

term strategies through subbasin assessment and planning (NMFS 2000). The long term habitat strategy in the BiOp has three overarching objectives: 1) protect existing high quality habitat, 2) restore degraded habitats on a priority basis and connect them to other functioning habitats, and 3) prevent further degradation of tributary habitats and water quality. These are consistent with the Vision Statement (Section 4.1), Guiding Principles (Section 4.2), and rules developed by technical team members during subbasin planning prioritization exercises (*refer to* Section 8.2.1).

The following objectives were more specifically described in the BiOp (NMFS 2000) as necessary for tributary habitat improvement efforts benefiting the Technical Recovery Team (TRT)-defined anadromous populations residing in the Snake Hells Canyon subbasin (See Assessment Sections 3.4.1 through 3.4.4). Related objectives and associated strategies in this plan include:

- Water quantity--improve tributary and mainstem flows to improve fish spawning, rearing, and migration (*refer to* Objective 8A).

- Water quality--improve water quality to both improve habitat condition and comply with water quality standards (*refer to* Objectives 8B and 8C).

- Passage improvements--address obstructions that interfere with or harm listed species (*refer to* Objectives 1A, 2A, and 3B).

- Watershed health--manage both riparian and upland habitat, consistent with the needs of aquatic and terrestrial species (*refer to* Objectives 7A, 7B, 9A, 9B, 10A, 10B, 11A, 11B, 14A, and 15A).

- Mainstem habitat--improve mainstem habitat and evaluate the results (*refer to* Objectives 1A, 2A and 8A).

In the long term, habitat recovery and watershed restoration for non-Federal public, Tribal, and private lands require state and local stewardship. An overall framework for this stewardship can be created through subbasin plans and recovery plans which establish goals, objectives, and priority actions that are coordinated across Federal and non-Federal ownerships and programs (NMFS 2000). The *Snake Hells Canyon Subbasin Management Plan* provides an important context for classifying and prioritizing areas for protection and restoration. The Plan also provides a foundation for ESA recovery planning.

Performance standards and measures are described in the "All H Strategy" (Habitat, Hatcheries, Harvest, Hydropower), which is the "umbrella" under which the BiOp falls (Federal Caucus 2000), and in the aquatics RM&E section (6.0) of this plan. Of the 4 H's, coordination with habitat standards and measures in the BiOp is of primary importance as development of strategies to address habitat concerns is a major objective of subbasin planning. Habitat performance standards are: 1) prevent habitat degradation, 2) restore high quality habitat, and 3) restore/increase habitat complexity (Federal Caucus 2000). Associated performance measures as described in the "All H Strategy" include (and are presented in the aquatics RM&E section in this document):

• Increased stream miles meeting water quality standards (temperature and sediments) (*refer to* Objectives 8B and 8C).

• Increased stream miles with adequate instream flows (*refer to* Objective 8A).

• Increased stream miles opened to fish access (*refer to* Objective 3B).

• Increased acres and/or stream miles of habitat protected or restored (*refer to* Objectives 3A through 15A).

The ultimate performance standard for habitat is fish productivity (Federal Caucus 2000). However, this will be difficult to establish as survival improvements from habitat actions cannot be measured in the short term. Even in the long term, measuring progress toward a biologically based standard will be challenging and expensive. Based on our current understanding of the associations between ecosystem processes and salmonid populations, four habitat factors will influence performance measures throughout the basin (Federal Caucus 2000):

- In-stream flows;
- Amount and timing of sediment inputs to streams;
- Riparian conditions that determine water temperature, bank integrity, wood input, maintenance of channel complexity; and
- Habitat access

The *Snake Hells Canyon Subbasin Management Plan* addresses each of these measures with detailed objectives and strategies as well as a research, monitoring, and evaluation plan (Sections 5 and 6, respectively).

7.1.1.2 Consistency with existing recovery plans

Not all federally listed species found within the Snake Hells Canyon subbasin currently have recovery plans in place or in development. The following provides an overview of those recovery plans (or a conservation strategy) that are existing or in development and relevant to species found within the Snake Hells Canyon subbasin.

Bull trout (*Salvelinus confluentus*)

Bull trout were listed under ESA as threatened on November 1, 1999 (64 FR 58910). The Bull Trout Recovery Team (BTRT) developed a draft recovery plan that provided a framework for implementing recovery actions for the species (USFWS 2002). The bull trout draft recovery plan was also used as the principal basis for identifying critical habitat for the species. The proposed designation of critical habitat was published on November 29, 2002 (67 FR 71236).

All bull trout found within the Snake Hells Canyon subbasin are considered part of Bull Trout Recovery Unit 11 (Imnaha–Snake River basins), as defined by the USFWS (2002). As detailed in section 3.4.6 of the accompanying *Snake Hells Canyon Subbasin Assessment*, the only known tributaries containing spawning and rearing bull trout within the subbasin boundaries are Sheep and Granite creeks. Data are lacking for population size, movement, and/or life histories of bull trout using this portion of the subbasin.

Several subpopulations of bull trout occur upstream of the reservoir influence of Lower Granite Dam, and migrants from these groups can move freely to and from Lower Granite Reservoir. These groups include fish from Asotin Creek and the Grande Ronde, Imnaha, Clearwater and Salmon rivers. Historic and current interaction among these populations is unknown, although presumably all historic bull trout populations periodically interacted with other populations in the Snake River basin. There is little evidence to suggest that these populations use habitat associated with the federal Columbia River hydropower system in the Lower Snake River (Assessment Section 3.4.6).

The *Snake Hells Canyon Subbasin Management Plan* provides mechanisms to reduce factors limiting bull trout. Objectives 3B, 8B, 8C, 11A, 11B and 15A directly address improvements of population and habitat conditions for bull trout and other focal species.

Bald eagle (*Haliaeetus leucocephalus*)

Bald eagles were listed under ESA as threatened July 12, 1995 (60 FR 35999), but are being considered for de-listing by USFWS as of July 4, 1999 (64 FR 128). Their population status is described as 'in recovery', with the breeding population doubling every 6-7 years.

The Pacific Bald Eagle Recovery Plan (USFWS 1986) addresses populations in Idaho, Nevada, California, Oregon, Washington, Montana, and Wyoming. The Snake Hells Canyon subbasin lies within the Snake River zone of the Pacific recovery area. Recovery goals for the Snake River zone are to: 1) locate, monitor, and protect nesting, roosting, and feeding areas, 2) develop nest site plans for nesting and roost areas, 3) monitor productivity, 4) prevent significant habitat disturbance and direct human interference at nest sites and feeding areas, and 5) re-establish six breeding pairs (USFWS 1986).

The *Snake Hells Canyon Subbasin Management Plan* provides mechanisms to reduce factors limiting bald eagle populations within the subbasin. Objectives 11A and 11B aim to protect and restore riparian and wetland habitats. Terrestrial Objective 12A is to protect and manage for mature, old growth stands of ponderosa pine, consistent with bald eagle needs. Strategies 13A2 and 13A5 encourage management for more natural fire regimes. Once achieved, objectives to enhance anadromous and resident fish population (Objectives 1A, 2A, 3A, 3B, 8A-C) will also enhance the prey base for bald eagles.

Lynx (*Lynx lynx*)

On March 24, 2000, the North American lynx (*Lynx lynx*) was federally listed as threatened (65 FR 16051) under ESA. Critical habitat has not been designated as no recovery plan currently exists for lynx. However, the Canada Lynx Assessment and Strategy (Ruediger et al. 2000) describes conservation measures and objectives (M. Hemker, USFWS, personal communication, April 6, 2004). In accordance with this interagency strategy, the USFWS, BLM, and USFS have cooperated to identify lynx analysis units (LAUs). Two LAUs have been delineated within the Snake Hells Canyon subbasin, encompassing the upper half of the subbasin. The LAUs in this subbasin are adjacent to LAUs in the neighboring Imnaha and Salmon subbasins (Assessment Section 3.1.2).

Ruediger et al. (2000) calls for addressing various risk factors affecting lynx productivity including restoration of ecological fire regimes, management of vegetative structure and landscape mosaics to improve habitat for lynx and its prey base, reductions in habitat fragmentation, and management of recreational activities.

The *Snake Hells Canyon Subbasin Management Plan* provides mechanisms for addressing various risk factors similar to those identified by Ruediger et al. (2000). Strategies 13A2 and 13A5 encourage management for more natural fire regimes. Terrestrial Objective 12A, 12B, and 13A focuses on addressing forest structure and resultant landscape mosaics and would be expected to benefit lynx/prey populations. Objective 14A addresses the impacts of the transportation system as it influences both habitat fragmentation and recreational uses throughout the subbasin.

Spalding's silene (*Silene spaldingii*)

Spalding's silene (sometimes called Spalding's catchfly) was listed as a Threatened species on 10 October 2001 (66 FR 51598). A recovery plan is in early stages of development and has not yet been released. The 2004 Conservation Strategy for Spalding's Catchfly (*Silene spaldingii* Wats.) (Hill and Gray 2004) is a useful interim guide for describing limiting factors, protection and restoration priorities, and additional survey needs (M. Hemker, USFWS, personal communication, April 6, 2004).

Two known populations of Spalding's silene occur within the Snake Hells Canyon subbasin. The Redensky Flat population in the Corral Creek drainage is the largest in Idaho and jointly managed by The Nature Conservancy and BLM (Hill and Gray 2003). The Redbird Point population is on private land approximately 20 miles south of Lewiston, Idaho. Both of these sites were discovered during rare plant surveys in 1993 and represented the first locations found within canyon grassland communities (Mancuso 1994). No populations are known to occur farther south within the subbasin or on the Oregon side of the Snake River, although unexplored potential habitat exists throughout the Snake Hells Canyon subbasin (Assessment Section 3.1.2).

Weed invasion, livestock grazing, and alterations of fire regimes including fire suppression, increasing fire severities and frequencies, and out-of-season fires, and habitat fragmentation all have potential to degrade Spalding's silene habitat (Hill and Gray 2004). Objectives 7A/B, 9A/B, and 10A/B and strategies 13A2 and 13A5 of the Snake Hells Canyon Management Plan address these same issues and are thus consistent with ongoing recovery and conservation efforts.

Fifty-two percent of Spalding's silene populations occur on private lands; not including the 12% of populations in which a private individual or corporation is a part-owner (Hill and Gray 2004). As a result, integration of Socioeconomic Objectives and associated strategies in this *Snake Hells Canyon Management Plan* (Section 5.2.3) are necessary for successful implementation of Spalding's silene protection and restoration activities.

MacFarlane's four o' clock (*Mirabilis macfarlanei*)

MacFarlane's four o'clock was originally listed as endangered in 1979 (44 FR 61912). Due to the discovery of additional populations and ongoing recovery efforts, the species was downlisted to threatened in March 1996. MacFarlane's four o'clock is endemic to the low-elevation

grassland habitats in the Imnaha, Snake and Salmon river canyons of Wallowa County, Oregon, and Idaho County, Idaho. It is currently found in 11 populations in Idaho and Oregon. Three of these populations are found in the Snake River canyon area within the Snake Hells Canyon subbasin, all of which occur on USFS land administered by the Wallowa-Whitman National Forest. Population sizes range from approximately 3,000 individuals on 100 acres at Tyron Bar to only 100 plants on 1 acre at the Pleasant Valley site (USFS 2003). The Pittsburg Landing site in Idaho has 2,024 plants scattered in eight distinct subgroups on a total of 9.3 acres. The Pittsburg Landing site occurs within an active cattle allotment, which has prompted managers to construct exclusion fences around some plants and initiate a long-term monitoring study in 2001 (USFS 2003) (Assessment Section 3.1.2).

MacFarlane's four o'clock and its habitat have been and continue to be threatened by a number of factors, including herbicide and pesticide spraying, landslide and flood damage, disease and insect damage, exotic plants, livestock grazing, off-road vehicles, and possibly road and trail construction and maintenance (USFWS 2000). Grassland protection and restoration efforts outlined in this Subbasin Management Plan (10A/B) are considered consistent with other ongoing recovery efforts for this species. Additionally, care should be taken to protect MacFarlane's four o' clock during noxious weed or other invasive exotic treatments (Objective 9A/B) prescribed in this plan.

Wolf (*Canis lupus*)

The gray wolf (*Canis lupus*) was listed as endangered under ESA on March 9, 1978 (43 FR 9607). On November 22, 1994, areas in Idaho, Montana and Wyoming were designated as non-essential experimental populations in order to initiate gray wolf reintroduction projects in central Idaho and the Greater Yellowstone Area (59 FR 60252, 59 FR 60266). Special regulations for the experimental populations allow flexible management of wolves, including authorization for private citizens to take wolves in the act of attacking livestock on private land (USFWS 1987). Recovery criteria for wolves in the Central Idaho Recovery Area is a minimum of 10 breeding pairs (or about 100 wolves) for a minimum of three successive years (USFWS 1987).

Wolves are currently not known to occur in the Snake Hells Canyon subbasin although suitable habitat exists. Wolves are considered to have been extirpated from Oregon. During 1995 and 1996, 35 wolves were reintroduced into central Idaho. The reintroduction was successful, and populations quickly expanded. By the end of 2002, approximately 263 wolves in at least 19 packs were living in Idaho (USFWS et al. 2003).

Objective 4A of the *Snake Hells Canyon Subbasin Management Plan* aims to increase understanding of the composition, population and habitat trends, and habitat requirements of the terrestrial communities of the subbasin. Objective 5A aims to maintain and enhance populations of various plant and wildlife species throughout the subbasin. These objectives (and associated strategies) support the necessary actions or "tasks" recommended by the USFWS (1987) to determine the present status and distribution of gray wolves in the Northern Rocky Mountains and devise a systematic approach for compiling observations and other data on the wolf. It is likely that general habitat management actions in this plan (weeds, fire, etc.) will have little effect on wolves themselves although effects on their main prey sources, elk and deer, should be considered in planning of future restoration projects.

7.1.2 Clean Water Act Considerations

Formed in 1970, the U.S. Environmental Protection Agency (USEPA) administers the federal Clean Water Act (CWA), requiring enforcement of water quality standards by states. These standards are segregated into *point* and *nonpoint* source water pollution, with point sources requiring permitting. Although controversial, this segregation means that most farming, ranching, and forestry practices are considered nonpoint sources and thus do not require permitting by the USEPA. In 1987, Congress established the Nonpoint Source Management Program under section 319 of the Clean Water Act (CWA), to help states address nonpoint source pollution by identifying waters affected by such pollution and adopting and implementing management programs to control it. These programs recommend where and how to use best management practices to prevent runoff from becoming polluted, and where it is polluted, to reduce the amount that reaches surface waters.

7.1.2.1 Nonpoint Source Pollution Control

In satisfaction of Section 319 of the CWA, the states of Idaho, Washington, and Oregon have developed similar nonpoint source control program plans (IDEQ 1999; WDOE 2000; ODEQ 2000). The documents represents a unified approach reflecting the State's intention to continue to plan, implement and prioritize actions to address NPS problems on a statewide basis, while avoiding undue duplication of effort (ODEQ 2000).

The state level nonpoint source program plans provide an "umbrella" under which all CWA activities within each state are consistent. The primary purpose of the Nonpoint Source Assessments and Management Programs is to provide the states and tribes with a new blueprint for implementing programs to address priority nonpoint source water quality problems. The focus is needed in order to identify innovative funding opportunities and to effectively direct limited resources toward the highest priority issues and waterbodies. Objectives and strategies in the *Snake Hells Canyon Subbasin Plan* shall be consistent and integrated with the water quality management plans in the state (NWPPC 2001).

The Idaho, Washington and Oregon Nonpoint Source Control Programs seeks to incorporate nine elements identified as necessary components for nonpoint source programs (IDEQ 1999; WDOE 2000; ODEQ 2000):

1. Explicit short and long-term goals, objectives and strategies to protect surface and groundwater.

2. Strong working partnerships and collaboration with appropriate state, tribal, regional, and local entities, private sector groups, citizens' groups, and federal agencies.

3. A balanced approach that emphasized both statewide nonpoint source programs and on-the-ground management of individual watersheds where waters are impaired or threatened.

4. The program (a) abates known water quality impairments resulting from non-point source pollution, and (b) prevents significant threats to water quality from present and future activities.

5. An identification of waters and watersheds impaired or threatened by nonpoint source pollution and a process to progressively address these waters.

6. The State reviews, upgrades, and implements all program components required by §319 of the Clean Water Act and establishes flexible, targeted, interactive approaches to achieve and maintain beneficial uses of waters as expeditiously as practicable.

7. Identification of Federal lands and objectives which are not managed consistently with State program objectives.

8. Efficient and effective management and implementation of the State's nonpoint source program, including necessary financial management.

9. A feedback loop whereby the State reviews, evaluates, and revises its nonpoint source assessment and its management program at least every five years.

The Guiding Principals and Objectives described in the *Snake Hells Canyon Management Plan* (Sections 4.1.1 and 5.2, respectively) are consistent with the key elements of the Idaho and Oregon nonpoint source control program plans. Goals have been established for various aspects of resource management. Monitoring and evaluation activities (Section 6) describe measurable short-term outcomes and expected biological response of implementation strategies. Working partnerships and collaborative efforts have been developed during subbasin planning and public involvement meetings (Section 1). Local involvement during activities in impaired watersheds has been recommended (Plan Section 5.2.3). Data gaps, research needs and monitoring activities are recommended and a feedback loop for adaptive management described (Section 6).

7.1.2.2 303(d) Listed Segments and TMDLs

Section 303(d) of the CWA requires that water bodies violating state or tribal water quality standards be identified and placed on a 303(d) list. Water bodies that do not meet water quality standards with implementation of existing management measures are listed as impaired under §303(d) of the CWA. It is each state's responsibility to develop its respective 303(d) list and establish a TMDL for the parameter(s) causing water body impairment (USEPA 2004).

Section 1.9.1 of the accompanying *Snake Hells Canyon Subbasin Assessment* describes water bodies within the subbasin that are listed under CWA §303(d). Temperature and sediment are the two factors listed under §303(d) of the CWA that have limiting effects on fish populations within the subbasin. Total dissolved gas (TDG), although not included under 303(d) listings, had been recommended for listing and was addressed in the recent TMDL developed for the Snake River (IDEQ and ODEQ 2001). Objectives 8B and 8C of this subbasin Management Plan directly address temperature and sediment concerns within the subbasin. Although total dissolved gas levels are not specifically addressed in this Management Plan, the negative impacts associated with operations of the Hells Canyon Dam and Complex are considered in Objective 1A, and would include any impacts from TDG. TMDLs relevant to §303(d) listed waterbodies within the subbasin are described in Section 3.3 of the accompanying *Snake Hells Canyon Subbasin Inventory*.

8 Prioritization

8.1 Prioritization of Aquatic Concerns

Aquatic concerns in mainstem habitats are collectively considered a high priority for protection and improvement of current conditions to enhance fish and wildlife status in the subbasin. Mainstem habitats are used by all focal aquatic species and are the primary habitats used by all life history stages of two focal aquatic species (fall chinook and white sturgeon). Based on Technical Team discussions regarding the importance of mainstem habitats to all species and on the interconnectedness of limiting factors within those habitats[3], no relative priorities have been assigned to mainstem areas or aquatic limiting factors within mainstem habitats. All opportunities to improve mainstem habitats in the Snake Hells Canyon subbasin should be viewed as high priority for implementation.

Prioritization of aquatic concerns in tributary habitats in need of protection and/or restoration is summarized from the Qualitative Habitat Assessment (QHA) presented in the subbasin assessment. See assessment section 4.1 and assessment Appendix H (which includes raw data and results of the QHA model) for additional detail regarding the derivation of priorities presented here.

Qualitative Habitat Assessment (QHA) (Mobrand Biometrics 2003) was used to evaluate the relative condition of habitat variables within 43 individual tributary streams or segments utilized by steelhead trout and to define and prioritize relative protection versus restoration needs of each stream. Although steelhead was selected as a focal species for QHA analysis, results are thought to generally represent needs of all focal species in tributary habitats (see assessment section 4.1.4).

Comparison of protection versus (adjusted[2]) restoration ranks for each reach evaluated indicates that most reaches clearly delineate themselves for either protection or restoration as the primary objective (Table 9). Seven stream reaches fall into the "middle ground" with respect to both priorities and are, therefore, prioritized for both protection and restoration activities.

Reaches prioritized for restoration activities are presented in rank order in Table 10, with priority habitat factors requiring restoration in each also delineated. Reaches prioritized for protection are presented in rank order in Table 11, with priority habitat factors requiring protection also delineated. In each of these tables, habitat factors in need of restoration or protection

[3] Limiting factors impacting mainstem reaches are primarily related to the operation of upstream hydropower facilities. Hydropower operations result in alteration of connectivity and flow, thermal and sediment regimes throughout mainstem habitats of the Snake Hells Canyon subbasin.

(respectively) are assigned relative priorities (1 = high, 2 = moderate, no score = low priority) using rankings drawn from the QHA model outputs[4].

In tributaries prioritized for restoration, the factors of greatest concern (limiting factors) are riparian condition, fine sediment, and channel stability (Table 10). Localized limiting factors prioritized for restoration in lesser numbers of tributaries include high and low flow, pollutants (associated with grazing activities), high and low temperature, channel form, and oxygen. Inherent in the definition of all restoration needs is the interim need to protect from further degradation those same issues until restoration activities can occur.

In tributaries prioritized for protection, priority issues include fine sediment, riparian condition, channel stability, and high flow (Table 11). In those streams, prioritized for both protection (Table 11) and restoration (Table 10) actions, prioritized factors often overlap. In these cases, measures should be implemented to protect against worsening of the current situation, with a longer-term goal of restoration of the necessary conditions.

[4] Readers are referred to assessment section 4.1.4 for discussion of adjustments made to QHA restoration scores to account for habitat availability, as well as adjustments made to original QHA outputs to simplify presentation and interpretation in the following tables.

Table 9. Comparative restoration versus protection value for streams within the Snake Hells Canyon subbasin based on (modified) QHA ranks for each activity.

Protection Rank / **Restoration Rank**[1]	**High (1-10)**	**Moderate (11-25)**	**Low (26-43)**
High (1-10) (Note: Cells in this row have streams listed in order of restoration rank)			Priority = Restore Captain John Creek Getta Creek Dry Creek Divide Creek Cave Gulch Redbird Creek Kirkwood Creek Corral Creek (N) Wolf Creek Big Canyon Creek
Moderate (11-20) (Note: Cells in this row have streams listed in order of restoration rank)		Priority = <u>Protect & Restore</u> Saddle Creek Salt Creek Sand Creek Sluice Creek Battle Creek Somers Creek Two Corral Creek	Priority = Restore Cottonwood Creek Corral Creek (S) Jones Creek Kirby Creek
Low (21-27) (Note: Cells in this row have streams listed in order of protection rank)	<u>Priority = Protect</u> Granite Creek Little Granite Creek Sheep Creek Temperance Creek Cook Creek Deep Creek Lookout Creek Tryon Creek Rush Creek Rattlesnake Creek Rough Creek Wild Sheep Creek Bull Creek	<u>Priority = Protect</u> Pleasant Valley Creek Durham Creek North Fork Battle Creek Stud Creek Hells Canyon Creek Bernard Creek Three Creeks	Priority = Protect Brush Creek West Creek

[1] A total of 43 streams/reaches were rated for both protection and restoration. Multiple ties in restoration rankings result in a maximum restoration rank of 27.

Table 10. Restoration ranks[1] for streams and habitat variables within each, for streams prioritized primarily for restoration within the Snake Hells Canyon subbasin.

Restoration Rank	Stream Name[2]	State	Length[3]	Watershed Protection[4,5]	Riparian Condition	Channel form	Channel Stability	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants[6]	Obstructions
1	Captain John Ck	ID	8.8	Craig Mtn	1	--	2	2	2	2	--	--	--	--	--
2	Getta Creek	ID	4.8	None	2	--	2	2	2	2	--	--	2	1	--
3	Dry Creek	ID	4.8	None	1	--	1	1	1	1	--	--	--	--	--
4	Divide Creek	ID	2.8	None	1	--	1	1	2	2	--	--	--	2	--
5	Cave Gulch	ID	4.6	Craig Mtn	1	2	1	1	2	--	2	2	2	2	--
6	Redbird Creek	ID	3.2	Craig Mtn	1	--	2	2	2	--	--	--	--	--	--
7	Kirkwood Creek	ID	3.9	NRA	1	--	2	2	--	--	--	--	--	1	--
8	Corral Creek (N)	ID	1.8	Craig Mtn	2	--	1	2	--	--	--	--	--	--	--
9	Wolf Creek	ID	0.6	None	2	--	2	1	--	--	--	--	--	--	--
10	Big Canyon Ck	ID	1.5	NRA	1	--	--	1	--	--	--	--	--	--	--
11	Cottonwood Ck	ID	0.9	Craig Mtn	2	--	2	1	2	--	--	--	--	--	--
12	Saddle Creek *	OR	5.7	Wild.	1	--	--	--	--	--	--	--	--	--	--
13	Salt Creek *	OR	2.8	Wild.	1	--	--	1	--	--	--	--	--	--	--
14	Corral Creek (S)	ID	0.7	NRA	1	2	1	1	--	2	2	2	--	2	--
14	Sand Creek *	OR	2.1	Wild.	1	--	--	--	--	--	--	--	--	--	--
16	Jones Creek	ID	0.7	NRA	--	--	--	1	--	--	--	--	--	--	--
17	Sluice Creek *	OR	2.2	Wild.	1	--	--	--	--	--	--	--	--	--	--
18	Battle Creek *	OR	1.5	Wild.	1	--	--	--	--	--	--	--	--	--	--
18	Somers Creek *	OR	1.4	Wild.	--	--	--	1	--	--	--	--	--	--	--
20	Kirby Creek	ID	1.0	NRA	--	--	--	1	--	--	--	--	--	1	--
20	Two Corral Ck *	OR	0.5	Wild.	1	--	--	1	--	--	--	--	--	--	--

[1] Uses "adjusted" reach ranks (previously described) to give weight to amount of usable habitat (stream length). When two variable ranks are presented, scores of 1 and 2 are used to illustrate relative priority; original ranks from the QHA model may differ, dependent on tie scores, and are presented in assessment Appendix H.

[2] Streams prioritized as "Protect and Restore" in Table 9 are included in both Table 10 and Table 11 and are marked with an asterisk (*).

[3] Measurement is an estimate of the length of channel utilized by steelhead rather than the overall channel length.

[4] Signifies the dominant protection status of the contributing watershed: Wild = Wilderness Area; NRA = National Recreation Area; Craig Mtn. = Craig Mountain wildlife mitigation or study area.

[5] Approximately the lower 0.25 mile of most streams is within the Snake Wild/Scenic River corridor and not afforded the greater protection often associated with the majority of the watershed. Exceptions are Redbird, Captain John, and Corral (N) creeks and Cave Gulch, which do not have portions contained within the Snake Wild/Scenic River corridor.

[6] For this exercise, "pollutants" include inputs related to grazing activities.

Table 11. Protection ranks[1] for streams and habitat variables within each, for streams prioritized primarily for protection within the Snake Hells Canyon subbasin.

Protection Rank	Stream Name[2]	State	Length[3]	Current Protection[4,5]	Riparian Condition	Channel form	Channel Stability	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
1	Granite Creek	ID	14.9	Wild.	1	--	1	1	1	--	--	--	--	--	--
1	Little Granite Creek	ID	1.3	Wild	1	--	1	1	1	--	--	--	--	--	--
1	Sheep Creek	ID	2.3	Wild	1	--	1	1	1	--	--	--	--	--	--
4	Bull Creek	OR	0.3	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Cook Creek	OR	0.6	NRA	1	--	2	1	2	--	--	--	--	--	--
4	Deep Creek	OR	0.5	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Lookout Creek	OR	0.3	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Rattlesnake Creek	OR	0.4	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Rough Creek	OR	0.3	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Rush Creek	OR	2.0	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Temperance Creek	OR	2.5	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Tryon Creek	OR	0.3	Wild	1	--	2	1	2	--	--	--	--	--	--
4	Wild Sheep Creek	OR	0.3	Wild	1	--	2	1	2	--	--	--	--	--	--
14	Battle Creek *	OR	1.5	Wild	2	--	2	1	2	--	--	--	--	--	--
14	Durham Creek	OR	0.1	Wild	2	--	2	1	2	--	--	--	--	--	--
14	Hells Canyon Creek	OR	0.2	Wild	2	--	2	1	2	--	--	--	--	--	--
14	N.Fk. Battle Creek	OR	0.3	Wild	2	--	2	1	2	--	--	--	--	--	--
14	Pleasant Valley Cr.	OR	0.3	Wild	2	--	2	1	2	--	--	--	--	--	--
14	Saddle Creek *	OR	5.7	Wild	2	--	2	1	2	--	--	--	--	--	--
14	Sluice Creek *	OR	2.2	Wild	2	--	2	1	2	--	--	--	--	--	--
14	Somers Creek *	OR	1.4	Wild	1	--	2	2	2	--	--	--	--	--	--
14	Stud Creek	OR	0.3	Wild	2	--	2	1	2	--	--	--	--	--	--
23	Bernard Creek	ID	1.5	Wild	2	--	2	1	2	--	--	--	--	--	--
23	Salt Creek *	OR	2.8	Wild	1	2	1	1	1	--	2	2	2	2	--
23	Sand Creek *	OR	2.1	Wild	--	--	2	1	2	--	--	--	--	--	--
23	Three Creeks	ID	Unk	Wild	2	--	2	1	2	--	--	--	--	--	--
23	Two Corral Creek *	OR	0.5	Wild	1	2	1	1	1	--	2	2	2	2	--

[1] Uses "adjusted" reach ranks (previously described) to give weight to amount of usable habitat (stream length). When two variable ranks are presented, scores of 1 and 2 are used to illustrate relative priority; original ranks from the QHA model may differ, dependent on tie scores, and are presented in assessment Appendix H.

[2] Streams prioritized as "Protect and Restore" in Table 9 are included in both Table 10 and Table 11 and are marked with an asterisk (*).

[3] Measurement is an estimate of the length of channel utilized by steelhead rather than the overall channel length.

[4] Signifies the dominant protection status of the contributing watershed: Wild = Wilderness Area, NRA = National Recreation Area.

[5] Approximately the lower 0.25 mile of most streams is within the Snake Wild/Scenic River corridor and not afforded the greater protection often associated with the majority of the watershed.

8.2 Prioritization of Terrestrial Concerns

The scale of the limiting factors impacting species and habitats in the Snake Hells Canyon subbasin dwarfs the financial resources available over the short term for protection and restoration efforts. Clearly, as not all problems can be fixed immediately with existing and potential resources; the limited resources available must be used as efficiently and effectively as possible. The number of issues and diversity of species and habitats impacted make prioritization a major task that must be periodically repeated and fine-tuned based on new information. Filling key data gaps (as outlined in the section 6.2 about data gaps) will further improve the accuracy of prioritization processes.

Prioritization for the terrestrial components of the *Snake Hells Canyon Subbasin Plan* was carried out collaboratively by the Terrestrial Technical Team. The group chose not to attempt prioritization at the strategy level because they felt that all the strategies under an individual objective functioned together, that all provided a necessary component to achieving the objective and should be implemented together. Priorities were developed at the level of the limiting factor, because objectives were also developed around the limiting factors prioritization is roughly at the objective level. The Technical Team developed a list of rules to help guide the prioritization process. They started this process with a list of rules that has been used in other subbasin planning efforts and modified those rules to make them most appropriate for the prioritization of activities in the Snake Hells Canyon subbasin. The Technical Team then used the rules to focus a discussion of terrestrial areas that are priorities for protection and restoration and to aid in the identification of priority actions in the Snake Hells Canyon subbasin.

8.2.1 Rules for Prioritization:

The Terrestrial Technical Team of the Snake Hells Canyon subbasin applied the following prioritization rules in determining priorities for the Snake Hells Canyon subbasin.

- Prioritize areas for restoration by focal habitat type. It is too expensive and impractical to address a particular limiting factor across the entire subbasin so efforts to address limiting factors will be focused in priority habitat types and areas of the subbasin.

- Protect existing high-quality habitat. Work from the areas in the best condition outward. Efforts to improve the status of fish and wildlife populations in the basin should protect habitat that supports existing populations that are relatively healthy and productive. Next, efforts should expand to adjacent habitats that have been historically productive or have a likelihood of sustaining healthy populations by reconnecting or improving habitat. The efforts should try to conserve the best areas of the subbasin and then build into areas with high need.

- Restore areas that build on current strengths and increase habitat connectivity.

- Prioritize strategies that benefit ESA listed species or prevent the need for listing imperiled species. Projects that benefit ESA targeted species or species with declining population trends should be prioritized over projects that do not.

- Prioritize for multiple species and benefits. Projects that benefit multiple species in single or multiple habitat types should receive priority.

- Maximize overlap between terrestrial and aquatic benefits. Efforts should address areas and limiting factors that provide the greatest benefit to both terrestrial and aquatic species and habitats.

- Prioritize projects that benefit fish and wildlife and local economies. When selecting among projects that offer similar biological benefit, choose projects that provide the most benefit to local communities.

- Prioritize strategies and activities that are practical and possible. Consider where a project or strategy is cost-efficient, whether it has beneficial or acceptable economic and social impacts, and whether it is likely to provide significant benefits within the scale of the limiting factors.

8.2.2 Application of Rules to the Snake Hells Canyon Subbasin

The discussion of the rules in the context of the subbasin generated a suite of decisions that provide prioritized framework for efforts in the Snake Hells Canyon subbasin. The Technical Team members reviewed the limiting factors, as well as the objectives and strategies they had developed for improving them, and discussed priority actions in terms of the rules. Highlights of the discussions generated by each rule are summarized below, and a list of the priorities established through this process is found in the following section.

Prioritize areas for restoration by focal habitat type—The Terrestrial Technical Team determined that protection efforts in riparian areas and herbaceous wetlands will provide the greatest benefit to the fish and wildlife populations of the subbasin. Secondary priorities include native grassland, ponderosa pine, and old-growth habitats.

Protect existing high-quality habitat—The Snake Hells Canyon subbasin contains large areas of remaining high-quality habitat continuing to protect those areas should be a priority. The subbasin's grasslands are particularly valuable because they are some of the most intact grassland habitats remaining in the Columbia Basin. Inventories of the habitats in much of the subbasin have been conducted, and areas containing mature ponderosa pine, other late seral forests, and high-quality riparian habitats have been identified. These areas should be preserved while additional inventories and data are collected. Preventing the spread of noxious weeds into areas of high-quality habitat is a priority.

Restore areas that build on current strengths and increase habitat connectivity—In most cases, restoration efforts in the subbasin should focus on degraded areas adjacent to or otherwise connected to high-quality habitats. In the case of noxious weeds, this will help prevent spread into high-quality habitats. In the case of habitat improvement this will provide larger areas of connected high-quality habitat.

Prioritize strategies that benefit ESA listed species or prevent the need for listing imperiled species. Preserving the ESA-listed species of the subbasin and preventing the need for listing of additional species is a priority. Priority species-specific issues identified by the Technical Team included further surveys for and protection of Spalding's silene populations particularly in the

Oregon side of the subbasin where survey efforts have been less intense, protection of rare plant populations, protection of riparian areas providing habitat for anadromous fish, protection of habitat for amphibians, protection of bat hibernacula, protection of areas supporting mountain quail, and reintroduction of mountain quail into suitable unoccupied habitats.

Prioritize for multiple species and benefits. Projects that benefit multiple species in single or multiple habitat types should receive priority.

Maximize overlap between terrestrial and aquatic benefits. Projects that benefit both terrestrial and aquatic species should be a very high priority. This rule was considered in establishing riparian habitats as the top priority habitat type for restoration and protection in the subbasin.

Prioritize projects that benefit fish and wildlife and local economies. The importance of maintaining the many recreational opportunities and sustainable natural resource-based economies of the subbasin was given consideration during the prioritization process

Prioritize strategies and activities that are practical and possible. Consideration of the potential costs (both economic and social) and benefits was given consideration during the development of priority actions.

8.2.3 Priority Terrestrial Areas and Actions

The organization of the priorities mirrors the limiting factors they address. The first group of priorities addresses habitat level limiting factors caused by the loss or degradation of important habitats. The second group of priorities addresses habitat level limiting factors related to land use in the subbasin. The final group of priorities is developed at the species level. Priorities were not developed between the groups i.e. all groups are of roughly the same level of priority but address issues at different scales. Within groups, the Technical Team developed priority actions and attempted to prioritize among the actions. Actions that occur in non-numbered lists can be assumed to be of roughly equal priority.

8.2.3.1 Group 1—Loss and Degradation of Habitat Limiting Factors

Priority 1—Protect and restore riparian and wetland habitats

- Protect and restore areas of current and historic mountain quail use.
- Protect and restore areas of anadromous fish use.
- Protect and restore areas containing rare plant or animal species.
- Protect and restore areas containing rare or unique plant communities.
- Protect and restore areas supporting amphibian populations.

Priority 2—Protect intact grassland habitats

- Protection of high-quality grasslands is top priority particularly in light of the high cost and paucity of understanding associated with grassland restoration.

- Protection of rare plant habitats within grassland habitats is of particular importance.

Priority 3—Protect mature ponderosa pine habitats

- Protect areas of mature ponderosa pine without established protection and prioritize larger areas, those that enhance habitat connectivity, and those that support focal and concern species.

Priority 3—Protect late seral structural condition

- Protect areas of late seral structural condition without established protection and prioritize larger areas, those that enhance habitat connectivity, and those that support focal and concern species.

8.2.3.2 Group 2–Land Use-Related Limiting Factors

Priority 1—Noxious weeds and invasive plants

- Prevent the spread of noxious weeds and invasive plants into relatively intact habitats found particularly in upstream portions of the subbasin.

- Eradicate small populations of noxious weeds and invasive plants before they have a chance to establish

- Improve outreach education programs in cooperation with established noxious weed groups.

Priority 1—Livestock grazing

- Eliminate disease transmission between bighorn sheep and domestic sheep by stopping domestic sheep and goat grazing in the subbasin; focus on public lands first and then private.

- Focus on developing grazing practices that are sustainable both biologically and economically.

Priority 2—Roads

Reduce the impact of roads on fish and wildlife by reducing road densities in

- High sediment-producing watersheds with anadromous fish.

- Areas of large big game winter range concentration.

- Areas where roads are dramatically reducing security areas or habitat connectivity

8.2.3.3 Group 3–Species-Specific Priorities

- Spalding's silene surveys

- Mountain quail surveys, habitat restoration, and reintroduction

- Add additional bat gates to protect important bat habitat threatened by vandalism
- Protect the vegetative composition and structure of the habitat corridor linking the Blue Mountains with the Rocky Mountains located in the narrow area of the upper subbasin.
- Establish additional transect or trend monitoring for Neotropical migrants.
- Establish comprehensive trend monitoring for unique or declining species groups, particularly Neotropical migrants, amphibians, bats, and concern or focal species.

9 Recommendations

9.1 General Recommendations

While the purpose of this process is to mitigate the impacts of the federal hydropower system on fish and wildlife resources, the purpose of this plan is to achieve in the Snake Hells Canyon subbasin "a healthy ecosystem, with abundant, productive, and diverse aquatic and terrestrial species and habitats. This includes providing for healthy human economies, recreation and cultures" (Hells Canyon Vision Statement). The Planning Team believes that implementing the objectives and strategies outlined in this plan will provide an initial step towards achieving the goals in this vision.

Some data and professional judgment exists to give direction on near term implementation projects, but the many data gaps need to be filled before a complete, holistic implementation can occur. The Research, Monitoring and Evaluation chapter of this plan provides an initial outline of information needed before a more comprehensive iteration of an implementation plan can be developed.

The Planning Team intends this plan to be a living document that will incorporate decisions made in other forums such as forest planning or the FERC process. This plan needs to be understood in the context of the US v. Oregon, existing sturgeon plans, the FERC relicensing of the Hells Canyon Complex, the HCRNA Comprehensive Management Plan, ESA recovery plans, and the many other planning efforts and documents affecting the subbasin. All these plans provide the context, and in many cases direction, for implementing the Hells Canyon Subbasin Plan.

Implementation in the Hells Canyon Subbasin needs to integrate the other major subbasins integral to the Snake in this area. Fish and wildlife are not always restricted to subbasin boundaries. For example, bighorn sheep recovery is dependent upon management of herds in multiple subbasins. Future work needs to integrate the results of multiple subbasin planning and implementation efforts to address these multiple subbasin issues.

The Planning Team intends that this plan will provide a structure for implementation and future research and planning in the Hells Canyon subbasin. Hopefully this plan will enable a streamlined process for project selection and implementation that reduces the bureaucratic nightmare to which we are all currently being subjected. If not, then we have wasted a huge amount of time and money.

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11 Appendices

11.1 Appendix A: Available or Estimable Abundance Goals and Current Status for Migratory Fish Species within the Snake Hells Canyon Subbasin.

Species	Goals	Long-Term Return	Natural Spawning Component	Hatchery Component		Harvest Component
				Broodstock Need	Rack Return	
Spring Chinook	Future	Undefined	25,000 @ LGR [1]	10,000@LGR[1]	Undefined	Undefined
	Existing condition	Unknown	Unknown	--	--	Unknown
Fall Chinook	Future	>26,800[2]	6,500[2]	4,100[2]	Undefined	>16,200[2]
	Existing condition	1396[3]	557[4]	1,300[5]	0[6]	0
Coho	Future	Undefined	Undefined	Undefined	Undefined	Undefined
	Existing condition	0	0	0	0	0
A-run steelhead	Future	62,200 @ LGR [7]	Undefined	Undefined	Undefined	Undefined
	Existing condition	Unknown	Unknown	--	--	Unknown
Pacific lamprey	Future	10,000 to 20,000[8]	Unknown	Undefined	Undefined	Undefined
	Existing condition	Unknown	Unknown	0	0	0
White sturgeon	Future	5,840[9]	Undefined	Undefined	Undefined	Undefined
	Existing condition	3,800[10]	3,800	0	0	Unknown

[1] CRFMP, which has expired (*U.S. v. Oregon*), establishes interim management goals for fish passing over the Lower Granite Dam; Snake River-specific goals are not defined.

[2] Draft Snake River Fall Chinook Production/Harvest Management Plan, January 2004.

[3] Fall chinook adults average at Lower Granite, 1991-1999, StreamNet database.

[4] Wild fall Chinook average 1991–1999, see assessment section 3.4.2.

[5] Broodstock estimate to provide Nez Perce tribal hatchery production of 1.4 million Age-0 smolts and FCAP production of 150,000 Age-1 and 500,000 Age-0 smolts. Future broodstock sources could include capture at Nez Perce tribal hatchery sites, in addition to captures at Lower Granite Dam and Lyons Ferry.

[6] Current broodstock comes from Lower Granite Dam and Lyons Ferry Hatchery.

[7] CRFMP, which has expired (*U.S. v. Oregon*), establishes interim management goals for fish passing over the Lower Granite Dam; Snake River-specific goals are not defined.

[8] Interim goal is based on historic (late 1960s) counts >30,000 at lower Snake River dams.

[9] IDGF goal is a population structure of 5,840 fish greater than 60 cm total length, 30% between 92 and 183 cm total length, and 10% greater than 183 cm total length.

[10] Population estimate from the Nez Perce Tribe project 199700900.